APRIL 11, 196 • VOL. 23 • NO. 10 • A SCHOLASTIC MAGAZINE

# SENIOR SCIENCE

For Classes in Biology, Chemistry, Physics, Earth and Space Science

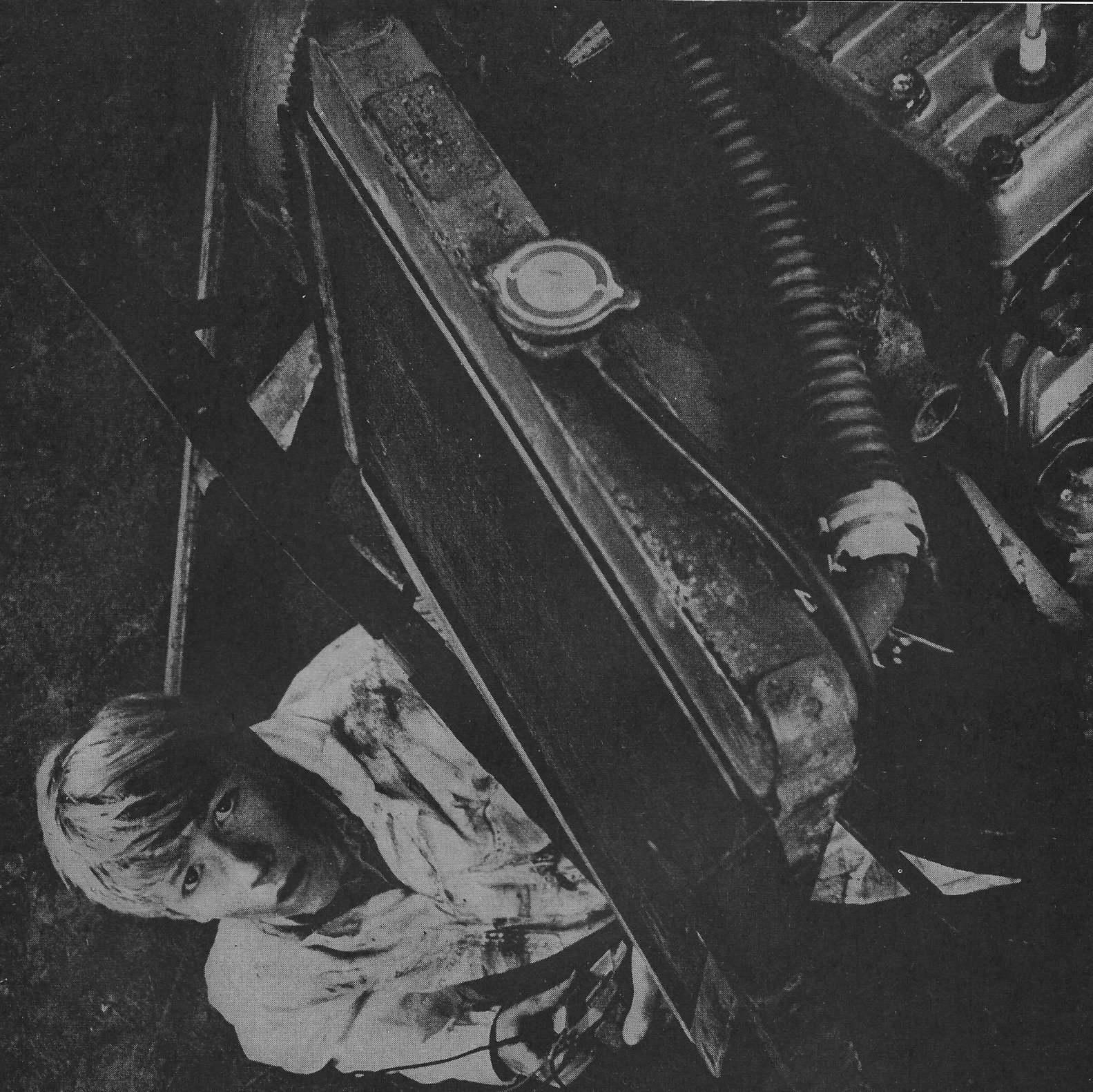
## Everglades Peril

In the very first boy-meets-girl story in the world, the girl knew how to get the boy... right? And you know what? Girls still do. Today a pretty girl knows how to succeed with boys without half trying. But let's face it. She's got a lot going for her—marvelous new cosmetics, smashing fashions, and Wonder Bread. *Wonder Bread?* Wonder Bread!

Wonder's the newest, neatest, nicest way to trap a boy since... well... since apples. Boys love the flavor of Wonder sandwiches, and the nutrition, and... what's inside the sandwich. Just try tempting him with his favorite Wonder sandwich. He'll bite. And—ZAP! You've got him.

WONDER
ENRICHED BREAD
*helps build strong bodies 12 ways.*

**Helps catch boys...!**



# BILL HOUSTON IS A GENIUS.

Bill may not be able to take all the knocks out of his engine the first time he tries to fix it. But he'll keep juggling those parts around until he does. Bill doesn't give up on a problem just because he can't figure it out right away. And that's why we call him a GENIUS.

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# HOW DO YOU RATE AS A DATE?

1. You just happen to be the best-dressed guy at the Saturday night dance. Do you:
   - ☐ Poke fun at the other guys.
   - ☐ Clue them in to the fact that your permanently pressed Van Heusen "417" shirt always stays neat and looks great on any dress-up occasion.
   - ☐ Put on your best James Bond routine and start flirting with the chaperones.
2. You're introducing a date to your Mother. Do you say:
   - ☐ "Sally, shake hands with my Mom."
   - ☐ "Mother, I'd like you to meet Sally Smith."
   - ☐ "Mom, this is Sally-the-girl I've - been - telling - you - about."
3. On a movie date, you suddenly discover that the picture bores you. Do you:
   - ☐ Try a few loud and long yawns.
   - ☐ Sit it out in silence if your date wishes to stay.
   - ☐ Pretend you're a deadly assassin and start shooting verbal "barbs" at the actors.
4. You bite into a hot dog and the mustard squirts on your new Van Heusen. Do you:
   - ☐ Wipe stains off with your tie.
   - ☐ Sponge off the stains and forget 'em, because new Soil-Away process in Van Heusen "417" Vanopress shirts lets you wash out stains without scrubbing.
   - ☐ Tell everyone you have a mustard-colored monogram patch on your shirt.

If you've checked the second answer for each question, you're a great date and you rate a free style and color chart by Van Heusen.

**VAN HEUSEN "417"**

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# ANSWERS TO BRAIN TEASERS

(see page 16)

## Fish Story

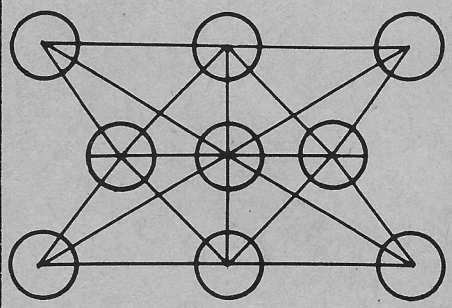
We know the head equals 6 inches. The tail equals 6 plus ½ the body, or $T = 6 + B/2$. We also know that if the body is equal to half the total length, then the body equals the combined length of the head and the tail, or $B = 6 + T$. State this in terms of T, $T = B\text{-}6$. We now have two equations which equal T, so we can state them equaling each other: $B\text{-}6 = 6 + B/2$. Then $B = 24$. Accordingly, the tail equals 18, and the total length is 48 inches.

## Chain Reaction

Joe can open the third link and give it to Griselda. He is left with a two-link section and a four-link section. Next day he can give her the two-link section and take back the one link. On the third day he can give her back the single link. On the fourth day he can give her the four-link section and take back the other three links. On the fifth day he gives her the single link. On the sixth day he gives her the two-link section and takes back the single link. On the seventh day he gives her the single link and she will have all seven.

## Nine to Ten

The nine coins can be rearranged as shown.



## Divide the Bread

The first traveler should receive seven coins and the second traveler should receive one. Imagine that they had cut the eight loaves into thirds to make 24 pieces. Each man would have eaten eight pieces. The first traveler contributed five loaves, or 15 pieces. He ate eight of them himself, leaving seven for the stranger. The second traveler contributed three loaves, or nine pieces. He ate eight of them himself, leaving one for the stranger. Thus, the stranger received one piece from the second traveler and seven pieces from the first. The eight coins should be divided accordingly.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But not just any old soap.

It simply has to be Jergens Clear Complexion Bar.

That's because it's really loaded with pimple-hating medications like allantoin and trichlorocarbanilide (a bacteria fighter), not to mention an oil mopper-upper, and a gentle nondrying skin cleaner that gets at trouble spots.

And if you simply wash your face with it twice a day, it'll do more to help get rid of pimples than a bunch of fancy claims.

"Surprise!"

**Jergens Clear Complexion Bar: Not just any old soap.**

FROM THE JERGENS SKIN CARE LABORATORIES

# SENIOR SCIENCE

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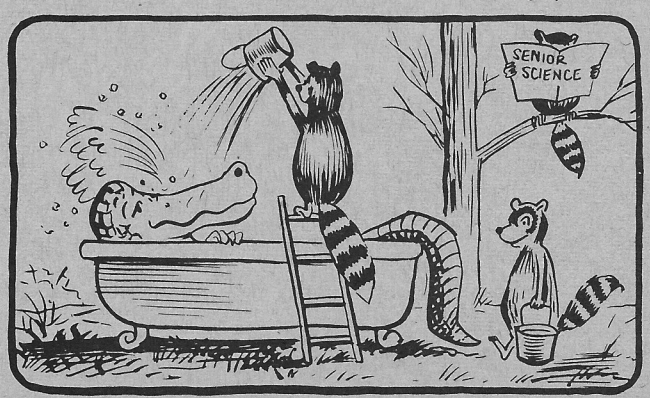
Cover photo: Leonard Lee Rue from Annan Photo Features

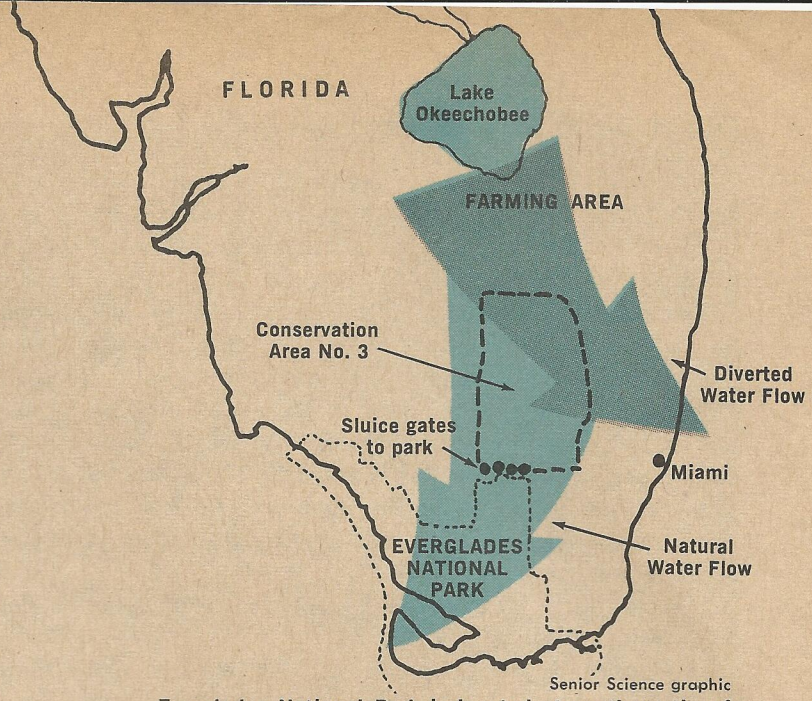
## Our Front Cover

The words on this week's cover are somewhat misleading – deliberately so. It is not that the alligator floating serenely in an Everglades swamp is a menace. Rather, this animal, and all the animals of the Everglades, are in mortal danger. Why? Read about the real peril in the Everglades beginning on page 4.

Drawing by Ted Blake



# LIFE OR DEATH FOR THE Everglades




**Everglades National Park is located at southern tip of Florida peninsula. Light arrow shows natural direction of water flow through Everglades. Dark arrow shows present flow, diverted by massive dike construction.**

PICTURE a swampy, primeval plain, where little has changed for eons, where we can roam the world as it was before the dawn of history:

Here is a marshy plain of sawgrass under a blazing subtropical sun – at first glance, a desolate wasteland. But what's that sloshing sound? A great white heron wades through marshy waters on stilt-like legs. Close by, another giant wading bird, the brilliantly plumed roseate spoonbill, searches shallow pools for small fish.

Suddenly – a loud clapping noise, as the powerful jaws of a crocodile clamp tight on a plump fish! Then, slithering down a muddy slope into a swampy channel, a sleek alligator!

Farther on, herds of white-tail deer roam the plain, as hidden panthers snarl from the cover of the brush. Wild hogs charge through the sawgrass. A bald eagle screams overhead.

Grotesque turkey vultures patrol the shore of a pond. On a tree stump a stately egret peers across the misty waters like a sentinel on a castle watchtower.

Farther yet, the gleaming mirror of a coastal mangrove swamp. Ghostly pink birds with snaky necks flit among the mangrove trees.

Is this a dream? No. You can actually take this safari into the past. You can wander through a "living museum," where things remain much as they were when the Earth was thousands, even millions, of years younger.

And we're not talking about a long, expensive trip to Africa or the jungles of South America. Nor a tour through a natural history museum for a look at stuffed specimens. Far from it. *This* region is part of our American heritage.

**Fisheating Creek Cypress Swamp, in south-central Florida, looked like this before man altered flow of region's waters.**
Annan Photo Features

By now you may have guessed that this "living museum" is the Everglades – a vast, marshy plain in the southwestern corner of Florida. In 1947, 1,400,000 acres of this area were set aside by the U.S. government as Everglades National Park. Millions of tourists have visited the Glades in the 20 years since then.

Recently, though, the very existence of Everglades National Park has been threatened. As you may know from newspaper and television coverage, a furor over the Everglades has pitted, on one side, conservationists – on the other, some politicians, farmers, real estate developers, and the U.S. Army Corps of Engineers.

Before we examine the controversy, let's take a closer look at the Glades themselves.

## Project Benefits Men

The *ecology* of the Everglades – the relationships among its plants, animals, and the environment – has depended on one thing down through the ages. That one necessity is fresh water.

Everglades National Park is only a fraction of the marshy plain of southwestern Florida. Take a look at the map on these pages. You'll see a big body of fresh water, Lake Okeechobee, at the top of the Glades region.

As the arrow shows, fresh water from the Okeechobee region tends to flow southwestward toward the Caribbean Sea and the Gulf of Mexico. The Glades have thus been like a great natural funnel. Fresh water has slowly percolated through the Glades, toward its destination in the Gulf and Caribbean.

This seaward flow, down through the centuries, turned the terrain into a vast fresh-water marsh – the home of heron, ibis, cormorant, stork, alligator, sea cow, tree orchid, crocodile, panther, and myriad other exotic species. Along the Gulf coast, where fresh waters meet the tide, the water is *brackish* – partly fresh, partly salt. Here grow the famous mangrove swamps.

*Continued on next page*

## Life or Death for the Everglades *continued*

But trouble came when man decided to alter the water supply of the Glades. In the late 1940's, the U.S. Army Corps of Engineers announced a flood-control program for all southern Florida.

Their plan called for the biggest evacuation job since the Panama Canal. They set to work digging drainage ditches and canals, erecting dikes and levees.

Today, the Central and Southern Florida Flood Control Project is nearing completion. Its levee walls, if put end to end, would completely encircle the States of Vermont and New Hampshire together! At least 75 dams and spillways, plus many hundreds of miles of canals, are in operation.

The cost of the vast project: expected to reach about half a billion dollars!

The project is very popular with farmers and real estate companies. Why? American naturalist Peter Farb points out that the flood-control project is also a vast land-reclamation project. Drainage will eventually bring some 735,000 new acres of land, once under water, into agricultural production. Moreover, the project provides irrigation water to the farmers, as well.

Real estate developers are happy because they have dry land to sell where before there were only swamps and marshes. For farmers, ranchers, and real estate developers, then, the government-sponsored flood control effort means more income.

Southern Florida's growing cities, such as Miami, also benefit greatly from the project. How?

Again, take a look at the map. The shaded arrow shows how the water that once flowed naturally into the Everglades has been diverted toward the Atlantic Ocean. Instead of nourishing the plant and animal life in the Glades, this water, shifted eastward by canals, levees, and dams, provides both irrigation water for drylands farmers, and drinking water for Miami and other cities.

Miami draws drinking water from wells that tap a porous layer of underlying rock. Such a water-saturated bed of rock, gravel, or sand is known as an *aquifer.* Miami's aquifer, in turn, is replenished by fresh water that flood-control engineers have diverted from the Everglades!

As men profited from this vast water-management scheme, the Everglades were literally dying. Summer and autumn had always brought the Glades a slowly moving carpet of water up to a foot deep, which immersed the land. Now, it was cut off at the northern source.

Why? Originally, the U.S. Army Corps of Engineers had planned to provide for the needs of man and the precious natural splendor of the Glades as well. The Corps dammed up billions of gallons of water in a huge, shallow, man-made lake at the northern edge of Everglades National Park.

This lake is known as Conservation Area No. 3. As you can see on the map, the Army built a row of sluice gates along the southern shore of the lake. By raising these gates, they could regulate the flow of water into Everglades National Park. Everyone agreed that enough water could be drained off through the sluice gates each summer and autumn to keep the water-dependent ecology of the Glades near normal.

### Animals Perishing from Drought

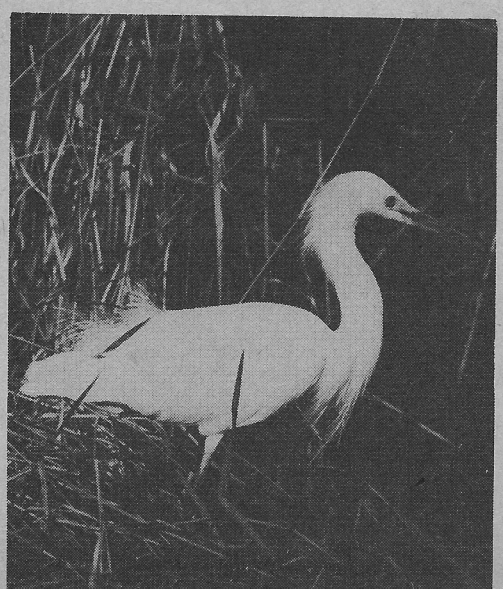
But pressure from farmers, ranchers, real estate developers, and the city of Miami soon cut off even the promise of water. The sluice gates were rarely, if ever opened!

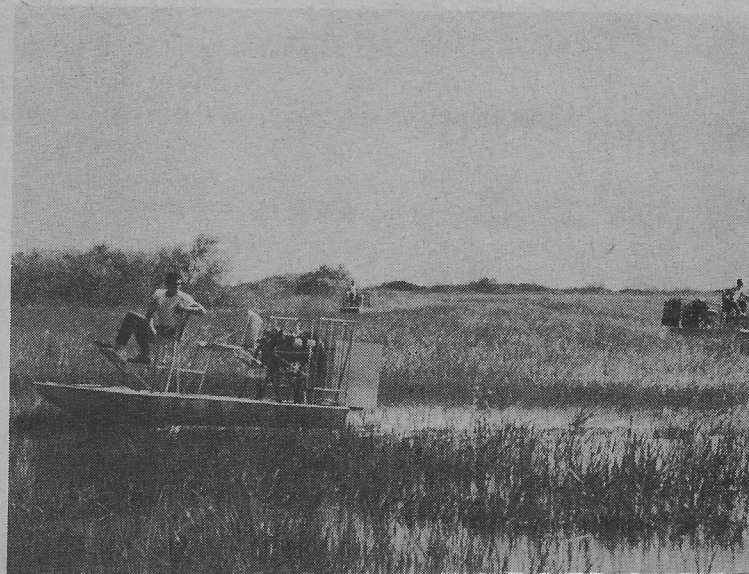
In 1965, naturalist Peter Farb made a report to the National Audubon Society and other conservationists who were desperate to prevent the extermination of water-starved wildlife in the Glades. Drought had hit Southern Florida. The sluice gates were kept shut. Mr. Farb crisscrossed Everglades National Park by land and by airplane to observe the parched landscape.

He reported, "Everywhere, I saw Everglades drying up, the last drops of water evaporating from water holes, creeks, and sloughs. Thousands of ponds that once looked from the air like fragments of a broken mirror were shriveled and caked. The sawgrass was a brown

**Airboat excursions in Glades's sawgrass marshes are exciting sport. As water declines, such boating will become impossible.**

**Snowy egret, high on directory of the Glades's beautiful wading birds, searches shallow pond for sight of frog or fish, its food staples. Egrets and other waders may perish as Glades dry.**





**A flamingo feeds in algae-slick pond. Flamingo's specialized bill has inlet and outlet channels for straining nutrients from the soupy water. Some flamingo species are bottom feeders, others skim surface waters.**
Arthur Fisher

and lifeless tinder . . . the sky darkened by great pillars of smoke billowing from a rampaging, crackling fire."

Park rangers strove frantically to save the perishing creatures of the Glades. They blasted holes in the scorched soil, hoping to hit ground water. This would provide life-sustaining ponds for dying gators, crocodiles, and water birds. They dug a huge emergency sump, or well, hoping to provide relief at least in one region until the sluice gates were opened. In a struggle against time, rangers and volunteer conservationists even lassoed crocodiles and other amphibians in order to carry them to what shallow pools remained.

But not only crocodiles were threatened by drought. Most creatures of the Glades, Mr. Farb reported, "are only the dramatic end-products of complex food chains that begin with tiny aquatic creatures. . . ." At the bottom of the "food chain" in the Glades are small organisms, such as mosquito larvae, whose life cycles require the land's watery submersion for much of the year. In effect, said naturalist Farb, kill off the mosquito larvae and you get rid of frogs and fish.Eventually, there will be no more glamorous, long-legged birds like the egret, which count on fish for food!

In 1965, National Audubon Society President Carl W. Buchheister proposed a way to save the dried-up Glades: Dredge and extend the old Miami Canal, so that it can bring fresh water directly from Lake Okeechobee to the sluice gates bordering the park! Mr. Buchheister stated: "The Miami Canal needs simply to be cleaned out and extended. This route would provide *six times* the amount of water that will be supplied by the emergency sump – and the total cost would be less than the money authorized by Congress for the Corps's *study* of ways to relieve the park's water shortage.

"A second step," he said, "is for Congress to authorize a deep-water reservoir in the conservation area north of the park."

Currently, the Army Corps of Engineers is studying these and other ways out of the dilemma. But conservationists warn that time is against the park's wildlife. Less than a year ago, for instance, thousands of animals perished during the dry season. Others fled the park in such huge numbers in search of water that Florida's Governor Claude P. Kirk, Jr., broadcast an urgent appeal to motorists to drive slowly "in order to save our animals as they cross the highways."

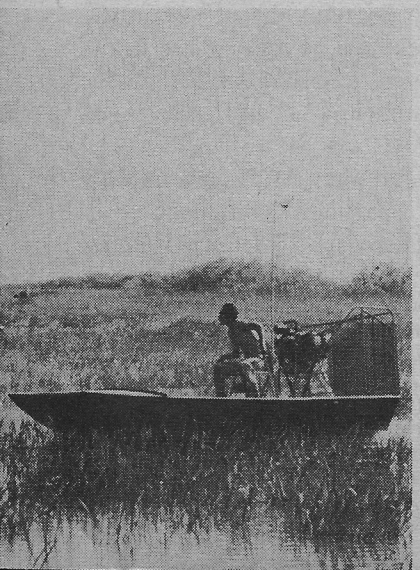
Some people feel that it is all right to turn the Everglades into a parched graveyard for wildlife, as long as man and civilization prosper. But conservationists believe our parks and wildlife are just as important, and that there is enough water to meet all our needs.

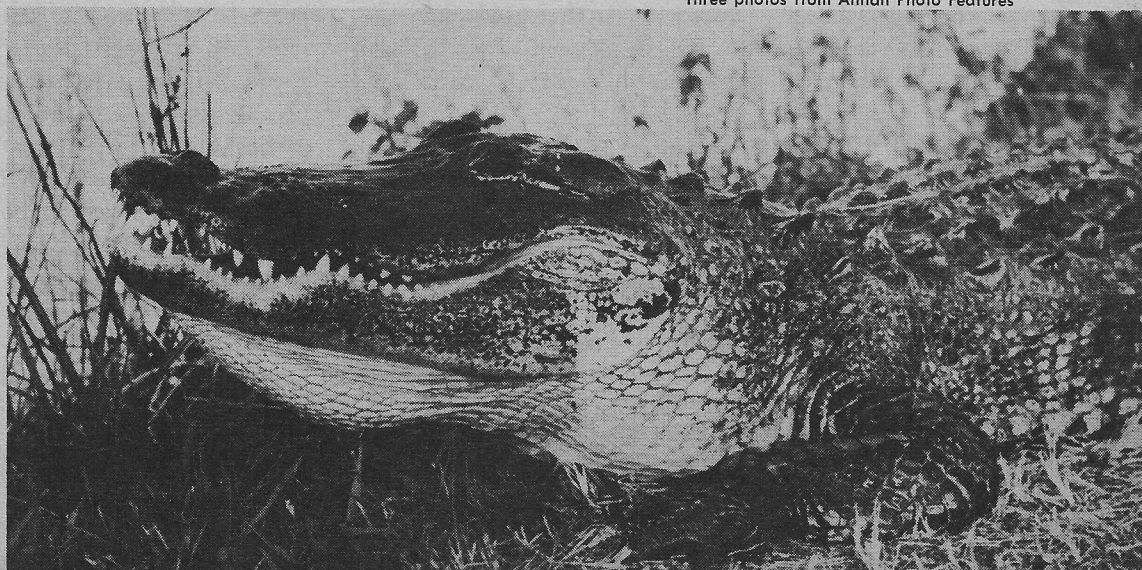
One such conservationist is Dr. Bryce M. Hand, a geologist at Amherst College, in Massachusetts. He points out that the final decision will affect not just the one million or so citizens of the Miami region, but the 200 million people of the United States. "And this," he says, "is without counting the unnumbered future generations whose only contact with alligators, wading birds, and cougars will be in museums."

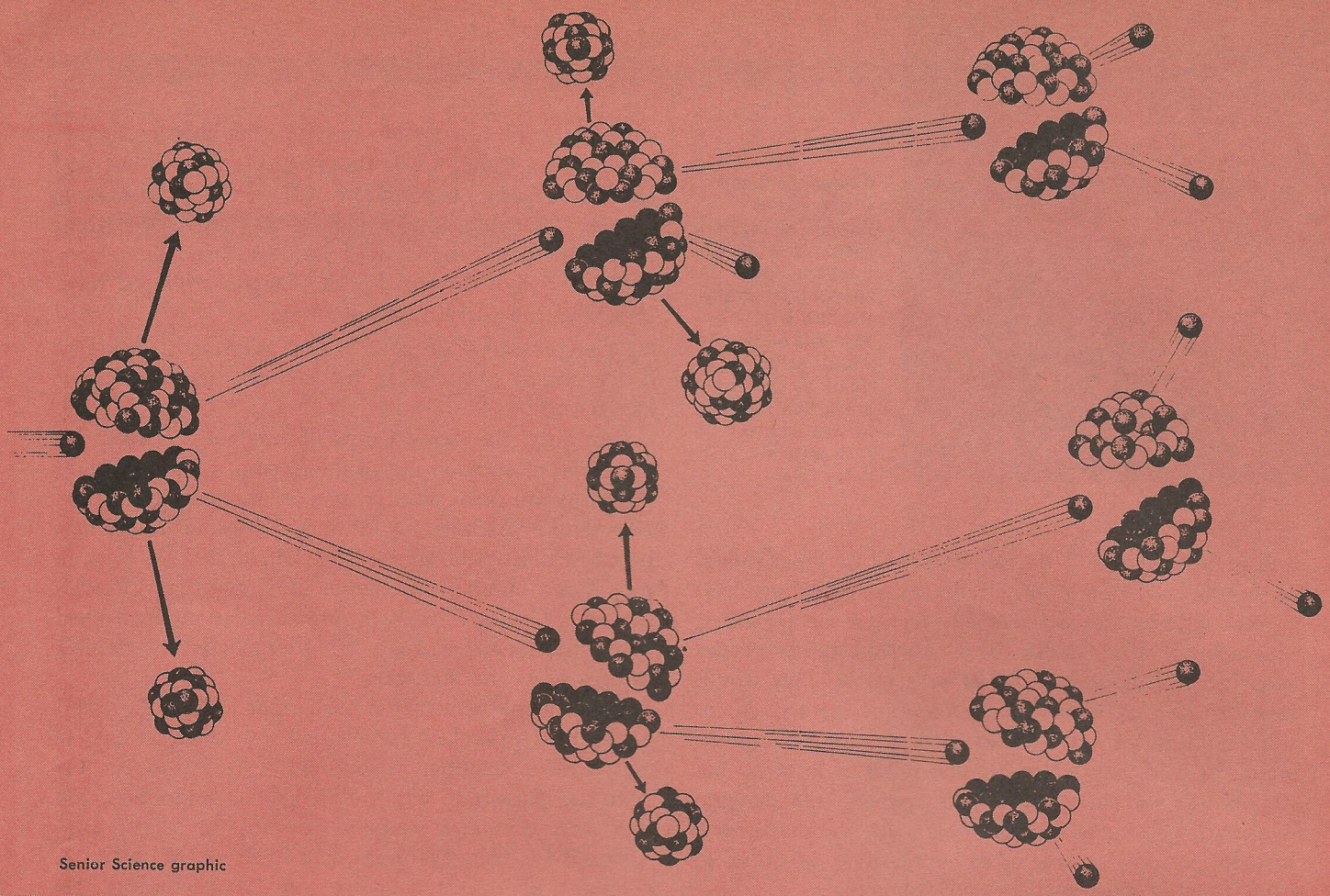
Each year, about a million tourists visit the Everglades. One day, you may be among them, if you haven't been already. If you think our government officials, and those of the State of Florida, should try to provide water to Florida's people – and *also* to the creatures of the ageless Everglades – why not write a letter that tells our officials how you feel? Before it's too late.

– JOHN SPEICHER

**Everglades "regular," the alligator, obligingly shows its teeth for cameraman. Gators have been hard hit by man and drought.**
Three photos from Annan Photo Features







Senior Science graphic

# The Promise of Plutonium

IN A ROUNDABOUT way, *plutonium* got its name from Pluto, the god of the underworld. In the opinion of the late Dr. Robert E. Wilson, a former member of the Atomic Energy Commission: "If there ever was an element that deserved a name associated with hell, it is plutonium."

Not only is plutonium highly radioactive and a chief ingredient of atomic bombs, it is also fiendishly poisonous. A microgram (one millionth of a gram — a quantity so small that it can't be seen by the naked eye) of the stuff will kill a person. It's more deadly than cyanide gas!

Many people have voiced regret that plutonium was ever discovered. Yet, this hellish element was not found in the Earth or in the atmosphere — it is man's own creation!

In 1940, Dr. Glenn T. Seaborg, Dr. Arthur C. Wahl, and Dr. Joseph W. Kennedy produced plutonium — element number 94 — by bombarding the radioactive element uranium with neutrons. (Neutrons are the uncharged particles that, with protons, make up the nuclei of atoms.)

A tiny speck of uranium was clobbered by a stream of high-speed neutrons from a radioactive source. Let's see what happened.

The uranium was a mixture of two uranium *isotopes* — one per cent of $U^{235}$ and 99 per cent of $U^{238}$. (Isotopes are atoms of the same element having different nuclear masses but the same chemical properties and atomic numbers.) When the nucleus of a $U^{235}$ atom was struck by a neutron, it split, forming two nuclei and releasing 2.5 neutrons and 200 million electron volts of energy in the form of heat. The released neutrons struck other $U^{235}$ atoms, releasing still more neutrons. (This nucleus splitting process is called *fission.*)

Of course, neutrons also struck the much more plentiful $U^{238}$ atoms. But instead of splitting, the struck $U^{238}$ atoms *absorbed* neutrons and moved up in mass to become uranium-239 isotope atoms. However, $U^{239}$ atoms proved very unstable. They decayed almost instantly — releasing beta particles (electrons traveling close to the speed of light) — and changed to *neptunium*-239 atoms. (*Neptunium* — element number 93 — was discovered earlier in 1940.)

Equally unstable, the neptunium-239 atoms rapidly decayed, also releasing beta particles. The decay product was plutonium-239. (There are 15 known isotopes of plutonium, ranging in atomic weight from 232 to 246; plutonium-239 is the most widely used isotope.)

**Above: First step in production of plutonium is nuclear fission (splitting) of uranium-235 atoms. When a neutron strikes the nucleus of such an atom, the nucleus splits and releases additional neutrons. They strike other nuclei, and a fission chain reaction is on.**

The 1940 experiments produced a mere trace of plutonium – a few picograms (trillionths of a gram). And two years later, a total of just a few micrograms of the element was available. Obviously, bombarding scraps of uranium was doing it the hard way.

Then, on the afternoon of December 2, 1942, a great breakthrough was scored. Beneath the stands of Stagg Field at the University of Chicago, the first self-sustaining nuclear chain reaction was achieved. And the way was opened for the production of plutonium in grams, kilograms, and eventually tons.

For some time before that fateful day, scientists knew that if enough uranium-235 atoms could be grouped close together, they would set up a nucleus-splitting chain reaction. But getting the $U^{235}$ atoms together was a problem. Natural uranium contains only one per cent of the $U^{235}$ isotope; all the rest is uranium-238. And when a $U^{235}$ atom releases a neutron, it is likely to be soaked up by a $U^{238}$ atom, or else released into space.

What would your next step have been?

The scientists refined some uranium to increase the proportion of the $U^{235}$ isotope in it. Then they enclosed it in a pile of graphite blocks to keep the neutrons in. Neutron-absorbing cadmium control rods were added. And the first reactor was ready.

## How It's Used

Plutonium production was not the main object of the first chain reaction experiment. Nevertheless, it pointed the way: the $U^{238}$ isotope component of the uranium in the reactor was changed (transmuted) to plutonium-239. Later, special reactors called *breeder reactors* were built. They contained just enough uranium-235 to sustain a chain reaction, and produced plutonium in sizeable quantities.

Why produce large quantities of plutonium?

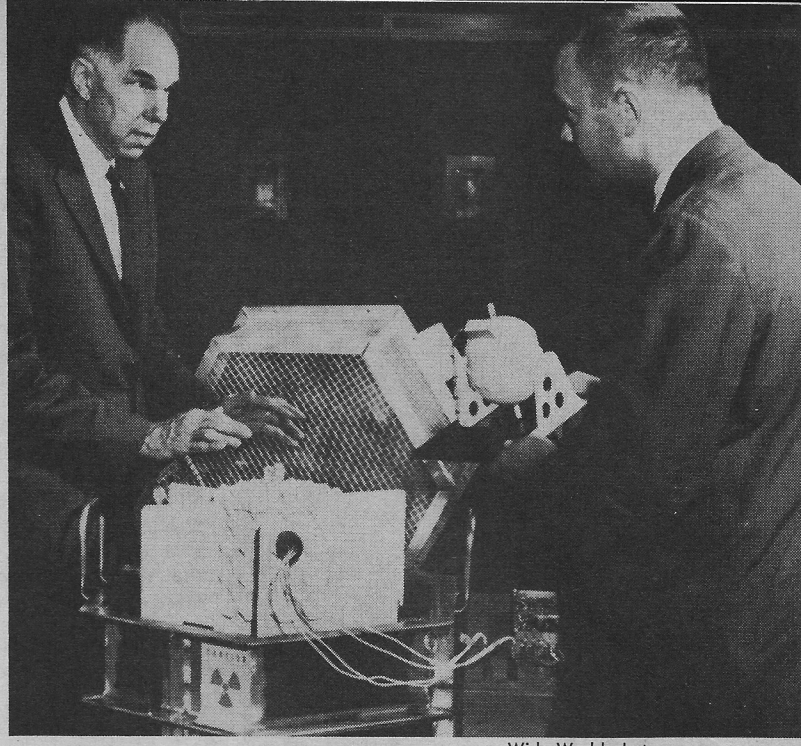
Like uranium-235, plutonium-239 is fissile – it can support a nuclear chain reaction. But, unlike uranium-235, it is neither extremely scarce nor expensive. Plutonium-239 is made from relatively plentiful uranium-238.

The first atomic bomb used in warfare contained pure uranium-235. But the second one was a plutonium bomb. And since then, plutonium has been extensively used in nuclear weapons and experimental power-generating reactors.

The energy locked in a minute quantity of plutonium is enormous. It's a much more efficient and longer-lived reactor fuel than uranium.

More recent breeder reactors use mixtures of plutonium and uranium. They produce several plutonium isotopes. Fifteen have been identified.

In addition to plutonium-239, four other isotopes of the element are particularly useful. Rare, extremely reactive plutonium-238 can generate sufficient heat energy to supply electricity on compact spacecraft and to power pacemaker units for regulating heart beats.



Wide World photo

**Dr. Glenn Seaborg (left), co-discoverer of plutonium, displays a type of "atomic battery" used on satellites. Decay of plutonium-238 in the battery generates heat energy, which is converted to electricity.**

Since it won't support fission, plutonium-240 is used to control reactors by preventing power surges. At the same time it is changed in the reactor to fissile plutonium-241 and plutonium-242. Both of these isotopes aid in the fission process. And plutonium-242 is especially useful in exploring elements beyond plutonium in the periodic table.

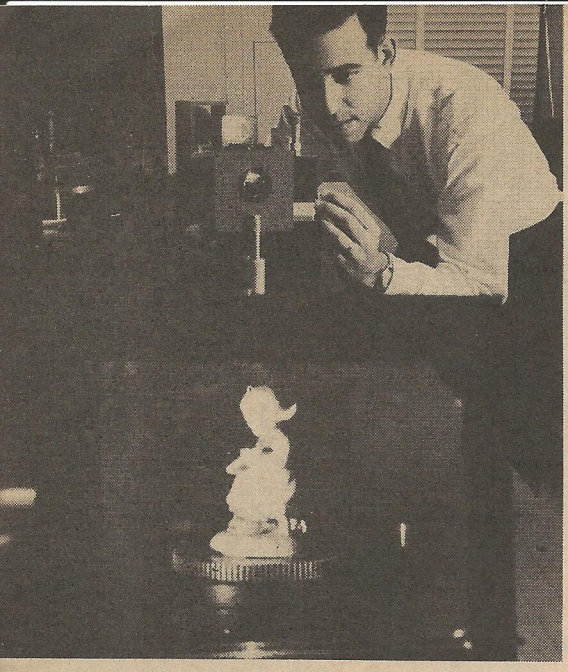
Plutonium is a metal, but it doesn't behave like one. In fact, it doesn't behave like any other substance known to man. Under some conditions it can be as soft and as plastic as lead. Under other conditions it can be as hard and as brittle as glass. Plutonium is *pyrophoric* – self-igniting; in moist air it will spout flame. When heated in dry air, it will burn and quickly crumble to powder. At room temperature, it slowly disintegrates. And between room temperature and its melting point (639°C), plutonium metal's crystal structure changes at least six times (six *allotropic modifications*).

Studying plutonium is no easy task. Necessary safety precautions make it hard to handle. Plutonium research is usually conducted in air-tight containers filled with inert gas. Scientists manipulate the material with robot arms or through shoulder-length rubber gloves fastened to the containers.

Every move with plutonium is hazardous. For even the shortest trip, the element must be tightly boxed. And cleaning the containers can be nightmarish. One whiff of plutonium dust spells death.

Dr. Glenn Seaborg agrees that, of all the substances known to man, plutonium is perhaps the most dangerous. Yet he foresees a great future for his "child": "Indeed, I predict that plutonium – ornery and unusual as it is – will turn out to be one of the most useful elements at our command."

– MICHAEL CUSACK



Bell Telephone Laboratories photos

**Bell Telephone Laboratories engineer lights up new kind of hologram with laser beam. An ordinary hologram provides a three-dimensional view of one aspect of an object. But this new hologram provides an all-around three-dimensional view of the object. By moving his head from left to right in front of the hologram, a viewer will see the object from all angles. Five-exposure photo on the right will give you an idea of what the viewer sees as he moves his head.**

# SCIENCE IN THE NEWS

## Star Talk?

During the past few weeks, radio astronomers have been scratching their heads over some puzzling signals received from outer space. Consisting of precisely spaced pulses of radio waves, the signals recur once every 1.3372795 seconds.

The signals come from the vicinity of a star located somewhere between Altair and Vega, two bright stars that dominate the summer sky. The faint, bluish star can be photographed only with the most powerful telescopes. As recorded by radio telescopes, the signal pulses come in minute-long trains, vanish for about three minutes, and then come on again.

The signals can be picked up at several radio frequencies and seem to have regular variations in intensity of pulses. The pattern of variation is different for each of the frequencies. This curious behavior, and its regularity, has put astronomers at a loss to explain the signals.

According to Sir Martin Ryle of Cambridge University, England, where the signals were first detected, "Our first thought was that this was another intelligence trying to contact us." Another suggestion is that the signals may come from some kind of space navigation beacon used by inhabitants of another solar system.

Although these speculations appeal to the astronomers who have made them, the scientists would prefer to find a natural explanation for the signals. But at the moment, no one has been able to come up with a "natural" cause. For one thing, the signals do not seem to come from collapsing or "dying" neutron stars, as astronomers had at first tried to prove. It's all "very spooky," says Dr. Frank Drake of the Arecibo Ionospheric Observatory in Puerto Rico.

## Ice Patrols

When the U.S. Coast Guard begins its annual International Ice Patrol this spring, the iceberg hunters will have some new and strange ice detectors. Lasers, radar, radiometers, and a weather satellite will help track the big chunks of ice that endanger North Atlantic shipping.

The Ice Patrol was organized 54 years ago in the wake of one of the sea's worst disasters. On April 14, 1912, the supposedly unsinkable luxury liner *Titanic* crunched into a huge iceberg off the fog-bound coast of Newfoundland. More than 1,500 died in what was the worst marine accident of all time.

The icebergs that menace the shipping lanes are chips off of huge "mother glaciers" located on the west coast of Greenland. Melting slowly, the icebergs drift southward on the Labrador Current. Using planes and ships, the Ice Patrol keeps seagoing vessels posted on the position of all bergs large enough to cause damage.

Patrol planes are equipped with special radar and a radiometer. The radar emits a precise, narrow beam that scans the sea surface and maps the contours of the bergs. The radiometer registers heat emitted by any object in the water. The instrument "takes the temperature" of suspicious masses on the radar screen, which might be fishing vessels or ships. If the reading is cold, the Coast Guard knows that it has found another iceberg.

The oceanographic vessel *Evergreen* will also be used in the hunt. Aboard the ship will be a new laser range finder. It will more exactly measure the contours and distances of the icebergs. The *Evergreen* will also investigate the temperature, speed, and direction of the Labrador Current. This will help scientists to predict the paths and distribution of icebergs.

## Plant Science

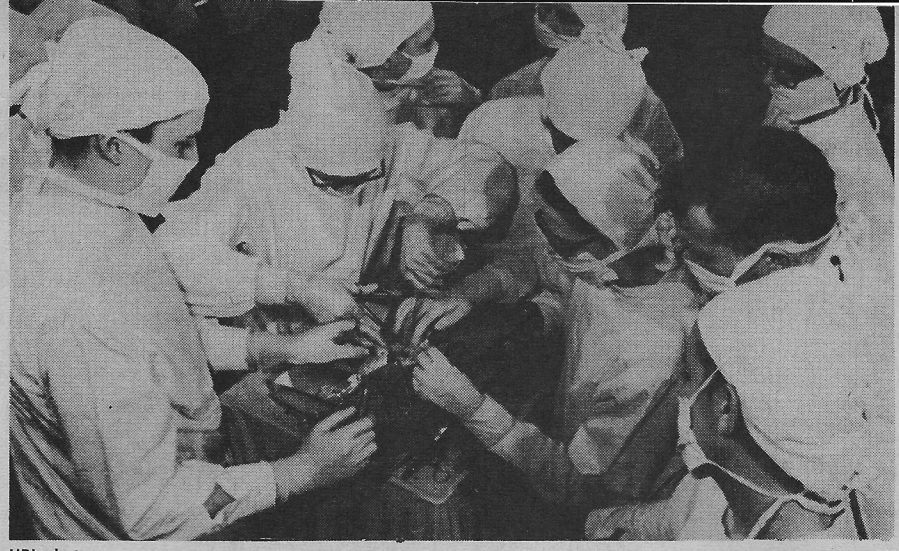
Bad news for weeds from the University of California at Davis!

Davis campus scientists know that farmers have waged relentless warfare against weeds, only to see them spring up again in full force the following season. The reason: Like many other plants, weeds have seeds that lie dormant over winter. Come spring, the seeds germinate (begin to grow). Some weed seeds slumber for years before germinating. "This is why, just when you think you've got all the weeds pulled out of your garden, new ones keep popping up," explains Dr. David Bayer, a plant physiologist at the Davis campus.

Dr. Bayer is studying plant growth hormones that stimulate out-of-season germination. He asks: Suppose a farmer could spray a weedy patch with such growth-stimulators during late autumn or early winter? Sprouting weeds would be killed off quickly by winter frost before they could manufacture new seeds! Thus, Dr. Bayer believes, weed reproduction cycles could finally be broken.

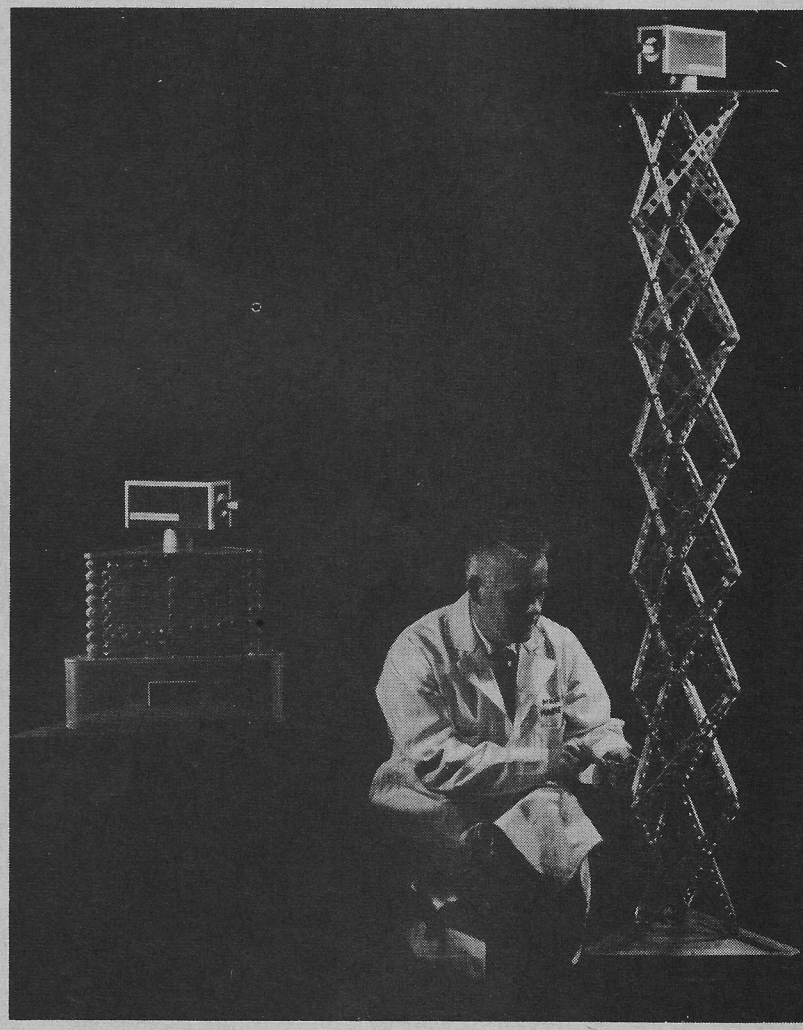
Another agricultural research project has won a patent for B. E. Shlesinger, a lawyer and amateur gardener who lives in Washington, D.C. Mr. Shlesinger's 17-year-old son Ed, and daughter Mary Kathleen, 14, share in the patent rights.

Experimenting in a greenhouse, the family put yellow plastic foil around corn sprouts. The reflected light slowed the growth of the plant stems, while the root systems spread. Normal corn stalks don't have wide-reaching roots. Well-rooted corn is better able to withstand a drought. Thus, the family's yellow reflectors may rescue drylands for corn agriculture!



UPI photo

**Student surgeons from Brookhaven High School in Columbus, Ohio, give "Oscar," a bullfrog, a new heart. "Oscar" lived for one hour after the two-hour transplant operation.**



**An erector set? No! This "space arm" expands ten times its folded size. On space landings, it bends and twists like a human arm to move radar equipment.**

Martin Marietta Corp.

## Locusts on the Move?

Across two continents, from East Pakistan to West Africa, farmers are maintaining a fearful sky watch. What troubles them? They dread the coming of one of man's oldest enemies – *a plague of locusts.*

Danger signs of migratory locusts on the move have been reported from West Africa, North Africa, Iran, Somaliland, Pakistan, and India. Those reports are causing great concern among scientists at the Anti-Locust Research Center in London, England. They remember the great locust swarm of 1956. In that year, dense dark clouds of locusts moved across large parts of the world, stripping crops from the fields and leaving near famine in their wake.

It is too early yet to tell whether large swarms are forming this year. But the scientists are taking no chances. They are studying long-range weather forecasts to see whether the climatic conditions of this coming year will favor locust swarming. Locusts tend to swarm in dry, warm periods in areas that are usually cold and wet.

If the swarming can be spotted early enough, the locust groups can be effectively bombed with insecticides. But once they have swarmed and billions of them are on the move, they are almost impossible to stop.

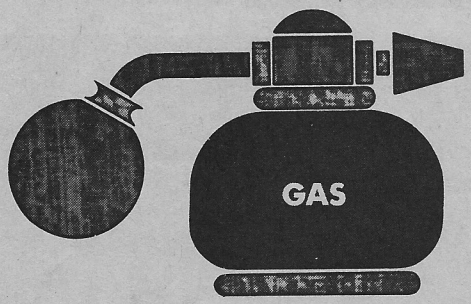
Why are locusts such a menace? Locusts are small – ten of them weigh less than an ounce – but they have fierce appetites. Ounce for ounce, they will eat 100 times as much as a human being. It was estimated that a 1956 swarm of about 40 billion locusts ate 80,000 tons of food a day. In addition to being great eaters, the migratory locusts are great travelers. They can cruise at 10 to 12 miles per hour for 20 hours at a time.

Why do locusts swarm at certain times? Naturalist Sir Basil Uvaraov suggests swarming is triggered by a *gregarious phase* (a desire to flock together). This occurs when young locusts (nymphs) are excited and made nervous by unseasonably warm weather. Swarming has been compared to the "spring fever" that causes students to swarm at such places as Fort Lauderdale, Florida. Once they've swarmed, the locusts – unlike the students – must constantly move to eat.

# THE CHRYSLERPEDIA

Is a bakery the only place you find a cream puff? Is direct drive a golf term? Who goes in for chopping besides a lumberjack? You'll find the answers here, in Volume Two of this encyclopedia of auto

## Volume Two: Carburetor to Downdraft




**Carburetor**—a device for mixing fuel and air in the proper proportions to produce a combustible gas. Works like a perfume atomizer or a garden spray. Air and fuel are drawn through the carburetor by the suction (intake stroke) of the engine, and are then diverted through an intake manifold and valve arrangement where they are exploded in the proper cylinder by a spark.

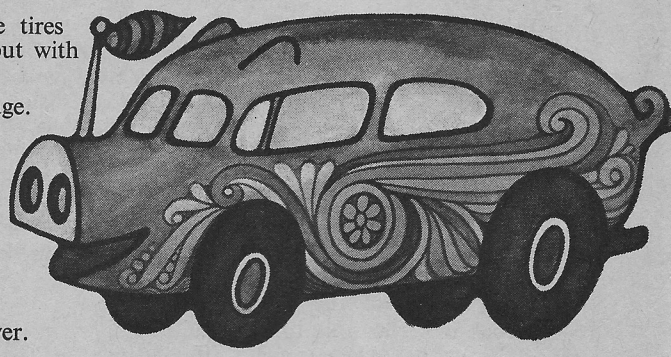
**Caster**—The angle of forward or backward tilt of the front wheel steering axis.

**Cheater Slicks**—Extra-wide tires made of racing rubber, but with a street tread.

**Choke**—Any reduced passage. More specifically, a valve placed in the carburetor air inlet to restrict the volume of air admitted.

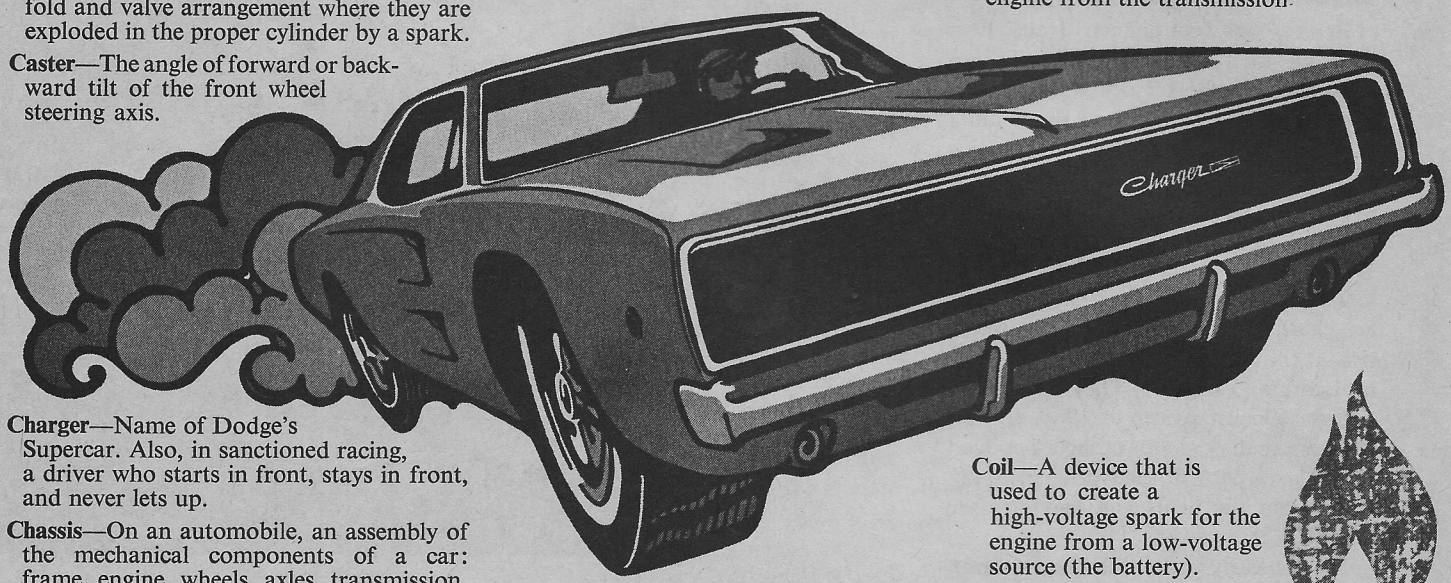
**Chop**—To reduce an auto body by cutting it down in height. Also, in sanctioned stock car racing, to cut in front of another driver.

**Chute**—In sanctioned stock car racing, the fast part of the track in front of the main grandstand. Also the device used to help stop a dragster.



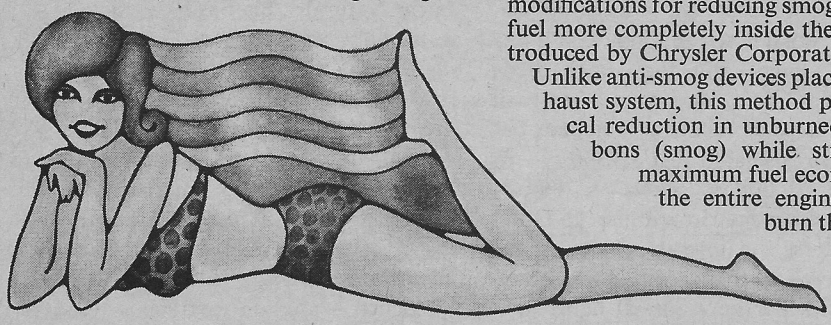
**Clunker**—A worthless car, usually a used one. Also referred to as a "pig" or "dog".

**Clutch**—A device, either automatically or manually operated, for disconnecting the engine from the transmission.



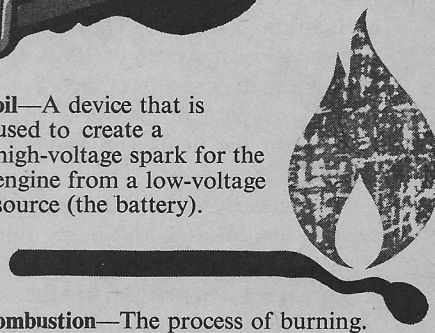

**Charger**—Name of Dodge's Supercar. Also, in sanctioned racing, a driver who starts in front, stays in front, and never lets up.

**Chassis**—On an automobile, an assembly of the mechanical components of a car: frame, engine, wheels, axles, transmission. On the beach, it means something else again.



**Cleaner Air System**—A system of engine modifications for reducing smog by burning fuel more completely inside the engine. Introduced by Chrysler Corporation in 1966. Unlike anti-smog devices placed in the exhaust system, this method permits radical reduction in unburned hydrocarbons (smog) while still allowing maximum fuel economy. In it, the entire engine works to burn the fuel more efficiently.

**Coil**—A device that is used to create a high-voltage spark for the engine from a low-voltage source (the battery).



**Combustion**—The process of burning.

**Combustion Chamber**—In an automobile engine, the space above the piston when the piston is at its uppermost position of travel.

**Compression**—In an automobile engine, the reduction in volume, or the "squeezing," of a gas (the fuel-air mixture).

**Compression Ratio**—The total volume of the cylinder and combustion chamber with the

# of AUTO ENGINEERING

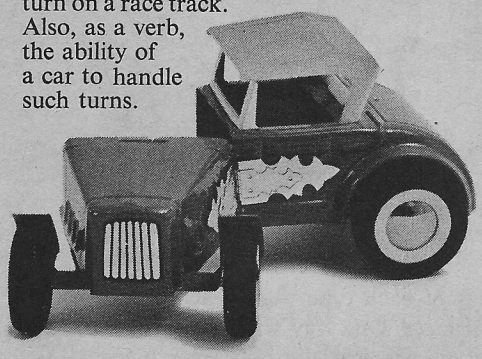
engineering. It's a series of informative—and we hope, interesting—facts to help you understand an automobile better. By Chrysler Corporation—the people who understand automobiles best.

piston in its bottommost position, as compared to the volume of the combustion chamber.

**Condenser**—A device in the ignition system that temporarily collects and stores a surge of electrical current for later discharge.

**Connecting Rod**—A rod that connects the piston to the *Crankshaft*.

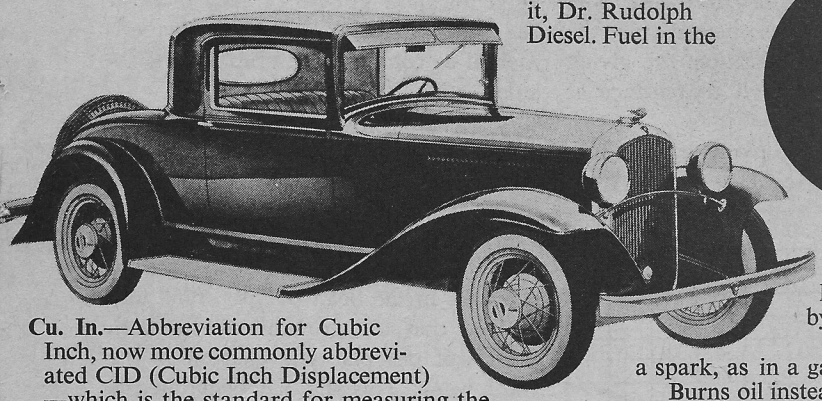
**Corner**—Any sharp, or relatively sharp, turn on a race track. Also, as a verb, the ability of a car to handle such turns.



**Crankcase**—The housing within which the *Crankshaft* and other parts of an engine operate.

**Crankshaft**—The main shaft of the engine which turns the up-and-down motion of the pistons into rotary motion to drive the wheels of the car.

**Cream Puff**—An exceptionally clean and desirable car—probably from Chrysler Corporation. Usually a used car similar to the 1931 Plymouth coupe (below).

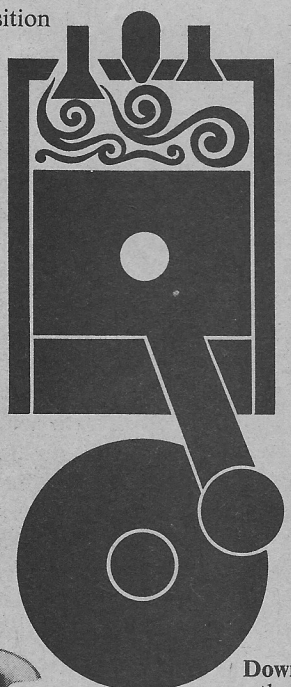


**Cu. In.**—Abbreviation for Cubic Inch, now more commonly abbreviated CID (Cubic Inch Displacement)—which is the standard for measuring the size or volume of U.S. automobile engines. The more cubic inches, the bigger the engine. Or to put it another way, "There's no substitute for cubes."

**Cut-out**—A device, illegal in most states, used to divert the exhaust gases directly to the atmosphere instead of through the muffler. Also, colloquial term for the verb "leave".

**Dash**—The partition between the engine and the driver. Also known as the firewall.

**Dead Center**—The position of the *Crankshaft* throw at which the piston is not moving in either direction, up or down.

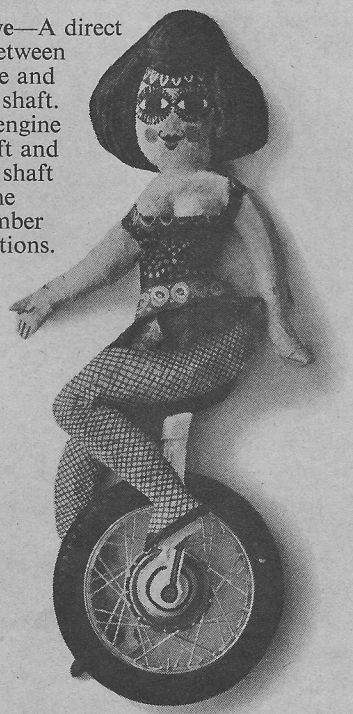


**Detonation**—Too rapid burning or explosion of the fuel-air mixture in the combustion chamber. You can hear it as a vibration of the combustion chamber walls.

**Diesel Engine**—Named after the man who developed it, Dr. Rudolph Diesel. Fuel in the cylinder is ignited by the heat generated by compression, rather than by a spark, as in a gasoline engine. Burns oil instead of gasoline, and has no spark plug or carburetor.

**Differential**—The system of gears at the end of the drive shaft that lets one drive wheel turn faster than the other, as in a turn.

**Direct Drive**—A direct linking between the engine and the drive shaft. Lets the engine crankshaft and the drive shaft turn at the same number of revolutions.



**Displacement**—See *Cu. In.* In one cylinder, the volume that is moved or displaced by the piston in one stroke. For total displacement, multiply by the number of cylinders.

**Distributor**—The electrical unit containing the points and rotor. The points make and break the circuit to the coil, producing a high voltage, and the rotor distributes the high voltage to the spark plugs.

**Dogging**—A racing term which means to stay on the tail of another car in a sanctioned race.

**Downdraft**—A type of carburetor in which the air-fuel mixture flows downward to the engine. Introduced on the 1929 Chrysler.

**Plymouth • Dodge • Chrysler • Imperial**
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**CHRYSLER CORPORATION**

*(Watch for Volume Three of the Chryslerpedia Soon. In the meantime, remember, the best driver is a safe driver.)*

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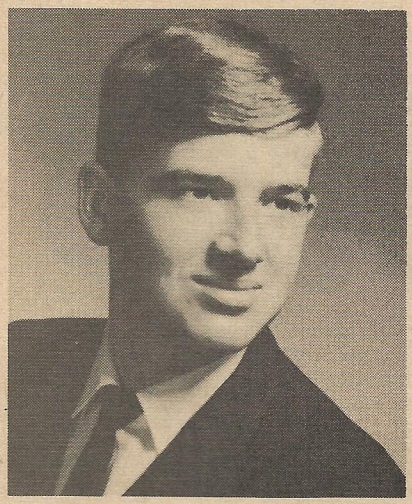
# tomorrow's scientists

# PROJECT: Wind and Plant Growth

RESEARCH BY: **FRANK HOLDER,** WINNER, FORD-FUTURE SCIENTISTS OF AMERICA AWARDS
SCHOOL: HARRISON (ARKANSAS) HIGH SCHOOL TEACHER: **MRS. JO ANNE RIFE**



Frank Holder photos

**Frank Holder built a wind tunnel (right) out of cardboard cartons for testing the effects of wind on plants. Fan at end of tunnel provided wind for the experiment.**

WHAT influences the growth of plants? Plant physiologists list temperature, water, light, and soil conditions among the principal factors. What about wind? Usually you don't think about wind affecting the growth of plants. But if you were to examine the plant life in windy environments, you would find that it definitely plays a role in their growth. Witness the stunted trees near mountaintops and the dwarfed plants of the tundra. Both environments are windy. *(See "Tundra Country," Senior Science, October 28, 1966.)*

Frank Holder noticed in pictures in a book about the desert that the average size of most of the plants was smaller than the average size of plants of the same species grown under normal conditions. Frank already knew that temperature and moisture conditions on the desert influence plant growth, but he wondered about the wind. Later, Frank read that the average wind velocities in deserts are higher than those recorded in nondesert areas. It led him to wonder just how wind affects plant growth. He decided to find out.

## Frank's Project

The experimental plants Frank chose were pea, bean, and coleus (a common ornamental plant of the mint family). A week before he actually began the experiment, he planted pea and bean seeds and purchased coleus plants from a local greenhouse.

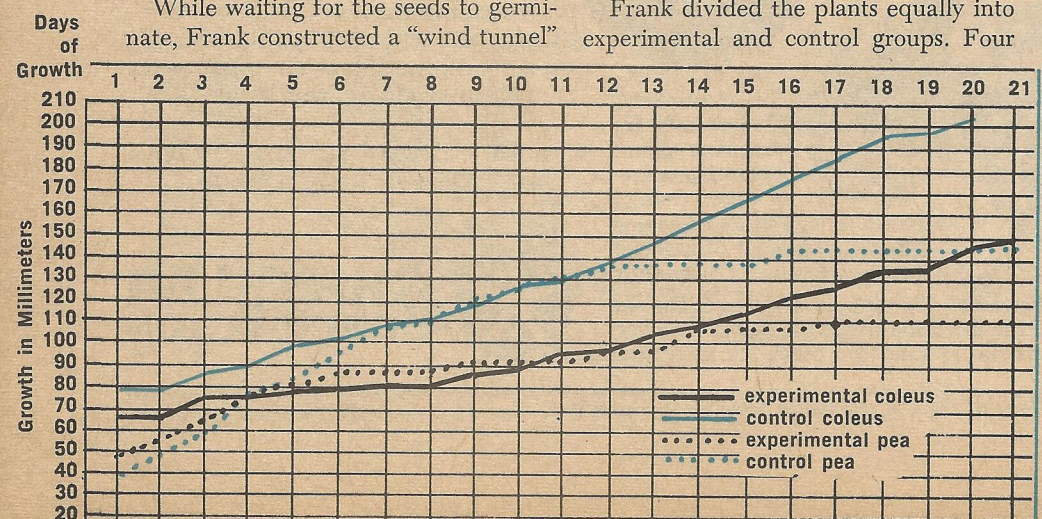
While waiting for the seeds to germinate, Frank constructed a "wind tunnel" out of heavy cardboard. Actually, it was a long tube open at both ends. Frank fitted a large portable electric fan at one end and set up a properly lit tray for the plants at the other end of the tube. Another tray, with identical lighting, was set up for control plants. Both trays were kept at the same temperature.

After the pea and bean plants had germinated, each flower pot was wrapped in plastic with the plant sticking through the plastic. This prevented evaporation of water from the soil. Water could, however, be lost from the plants through transpiration, the giving off of moisture through the surface of leaves and other parts.

Frank divided the plants equally into experimental and control groups. Four plants of each type were placed in the plant trays. One tray was placed in the wind tunnel, and the other was placed in the control area out of the wind.

With the exception of the wind, then, all factors remained equal throughout the course of the experiment. Frank measured the daily growth of each plant using a ruler marked off in millimeters.

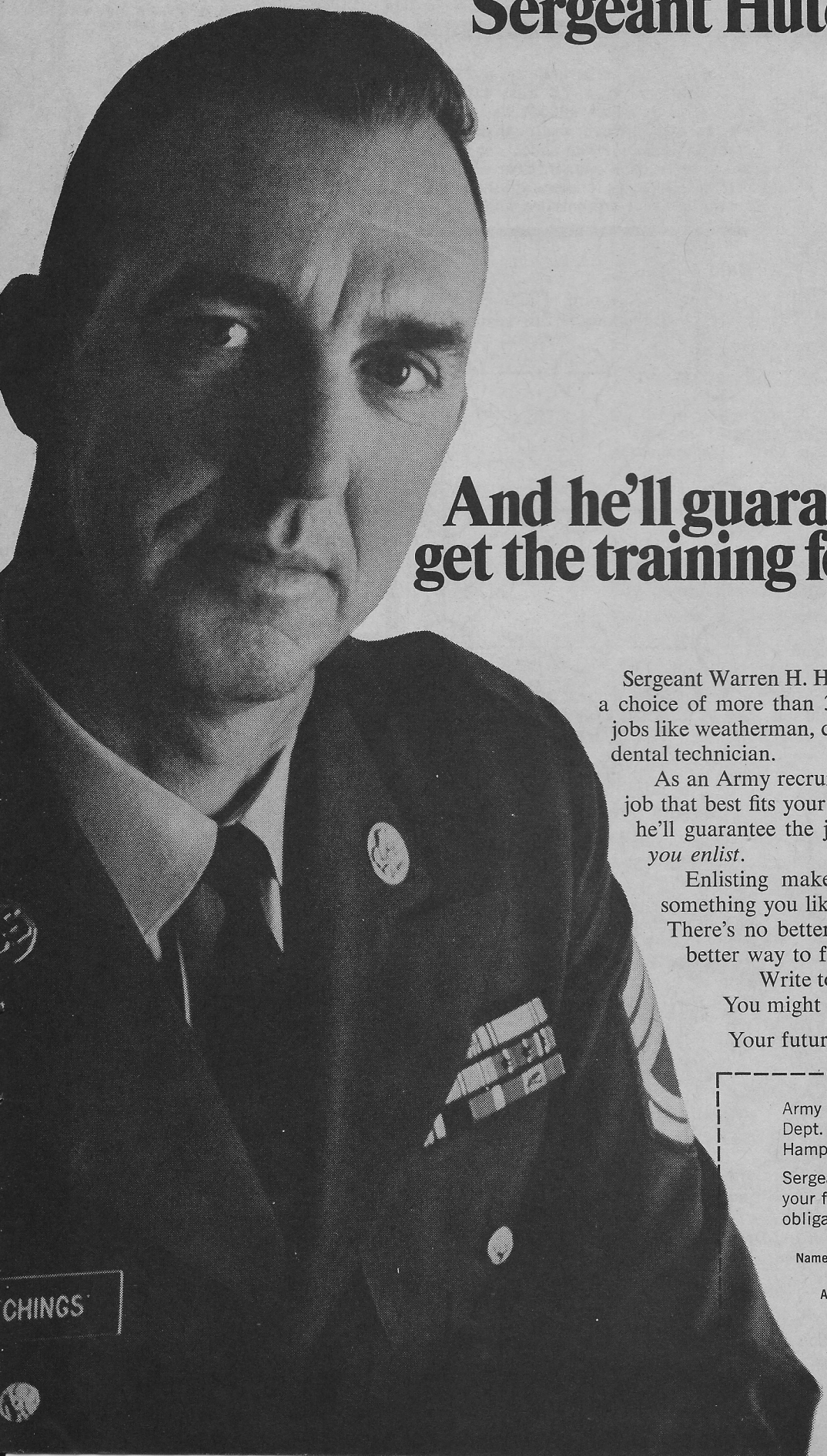
Frank collected data from both the experimental and control plants for 21 days. After he had all the data, he averaged the daily growth of each plant of the same species and group (experimental or control). He graphed the results.


Days of Growth
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
Growth in Millimeters
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20
experimental coleus
control coleus
experimental pea
control pea

## Frank's Results

The results show that wind slows down the rate of plant growth. However, it took about 13 days for any significant difference in growth rate to show up in the bean plants. Frank also noticed that the growth rate for both groups of pea plants leveled off in the third week. This did not occur in the other species. Can you give any explanation for this phenomenon? Can you suggest further experiments to follow up Frank's work?

# Order the job you want from our Sergeant Hutchings.

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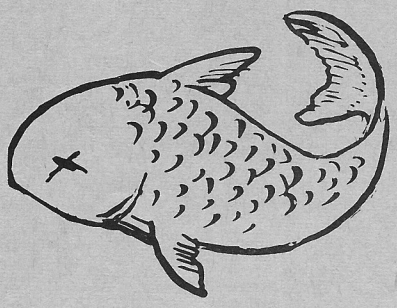
ANSWERS ON PAGE 2

# brainteasers

**Do you have a favorite brain teaser? Send it to Senior Science, 50 West 44th St., New York, New York 10036. We will pay five dollars for each one published. Include the name of your school, home address, grade, and age. In case of duplicate submissions, choice will be made on the basis of presentation and clarity.**

## Fish Story

Joe caught a fish that had a head six inches long. Its tail was as long as the head and half the body combined.



The body was half the whole length of the fish. How long was this fish altogether?

*Mike Breggar*
*Bala Cynwyd Jr. H.S.*
*Merion Station, Pa.*

## Chain Reaction

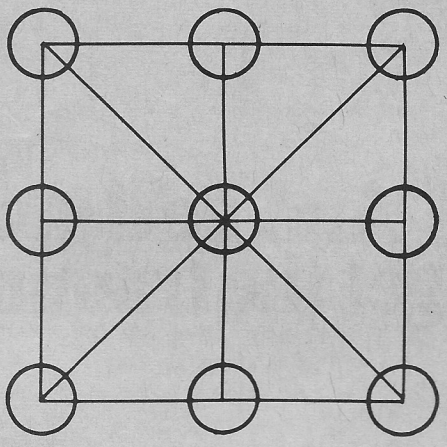
Joe wanted to give his girl friend a lovely chain bracelet composed of seven large links with a catch to join the two ends. Griselda, his girl friend, would not accept the bracelet, because she didn't think she had known Joe long enough.

However, she said she would accept it if he would let her have one link that day, and an additional link on each of the subsequent six days. However, Griselda would not consent to having Joe open more than one of the links in the chain. Can Joe comply with Griselda's terms?

*Colin Ward*
*Saint John XXIII School*
*North Bay, Ontario*

## Nine to Ten

Below is a diagram of nine coins arranged in eight rows of three each. Can

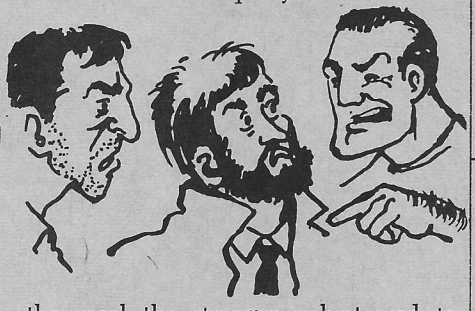


you suggest a rearrangement that would form ten rows of three each?

*Cathy Alterman*
*St. Trinity Lutheran S.*
*Pontiac, Mich.*

## Divide the Bread

Two travelers stopped for a midday meal. The first traveler had five loaves of bread; the second had three. A stranger joined them and the three shared the bread equally. At the end of



the meal the stranger volunteered to pay for his share with eight small coins of equal value. How should the two travelers divide the stranger's coins to properly reimburse themselves for the loaves of bread they had contributed to the meal?

*Robert Scherrer*
*Peckham Jr. H.S.*
*Milwaukee, Wis.*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## Scorekeeper

**(see page 18)**

I. The Promise of Plutonium

1.F; 2.T; 3.F; 4.F; 5.T; 6.T; 7.T; 8.F; *9.T; *10.F.

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SUM-MARY # SS48


## FOLLOWING THE FILMS

### A DANDY IN ASPIC
(Columbia)

The double life of a double agent makes this spy film one of the most unusual and intriguing to hit movie screens since Harry Palmer cracked *The Ipcress File*. Alexander Eberlin (Laurence Harvey) is on the payroll of British Intelligence. But he is in reality a Russian in the pay of the Soviets, a skilled assassin who secretly does away with top British agents. However, his glacial nerveless front begins to crack when his British employers order him to seek out and destroy the mysterious murderer who is thinning their ranks.

For a long time, Eberlin has been begging his Soviet masters to let him come in out of the cold. They refuse, hoping to use him for their own advantage right up to his inevitable end. When he is sent to Berlin they aid and abet him in the sinister game of cat-and-mouse he is forced to play with British agent Gattis (Tom Courtenay). Eberlin needs all the help he can get. Gattis hates and suspects him.

As Eberlin moves closer to his final confrontation with Gattis, he begins to have feelings not usually permitted a double agent. He learns to know fear and hatred himself – and he almost falls in love with an English girl (Mia Farrow). But these emotions are luxuries no spy can afford for long. It is hard not to feel more than a little sorry for Eberlin.

Derek Marlowe's novel, from which this film is adapted, is a classic study of the world of espionage. But the film goes the book one better by permitting Laurence Harvey to give the character of Eberlin depth and perception. As Harvey plays him, Eberlin is not the superficial, cold craftsman of Marlowe's novel, but a hunted human being with no place to go.

### NO WAY TO TREAT A LADY
(Paramount)

This is a film about a psychopathic strangler who preys on middle-aged women. *Question:* why is it so entertaining? *Answer:* Because it is completely unreal. Its characters are cartoon caricatures operating in a brightly

*Continued on Page 19*

# SCOREBOARD

How well have you read your *Senior Science*? Answers to questions with no asterisks may be gleaned directly from the articles. Answers to questions with an asterisk (*) require fusing the facts in the articles with those learned in the classroom or from your reading. Answers are in the SCOREKEEPER on page 16.

## I. The Promise of Plutonium

_____1. Plutonium was discovered as a result of analysis of the end products of nuclear fission.
_____2. Plutonium is an extremely poisonous metallic element.
_____3. Isotopes are atoms that have the same atomic weight but different atomic number.
_____4. Uranium-235 is the only known fissionable material.
_____5. When the element neptunium-239 undergoes radioactive decay, the daughter product is plutonium-239.
_____6. There are at least 15 known isotopes of plutonium.
_____7. Like cadmium, plutonium-240 can be used as neutron absorbing control rods in an atomic pile.
_____8. Plutonium-239 is both scarce and expensive.
_____*9. Uranium-238 undergoes fission when struck by a fast-moving neutron.
_____*10. Because it has a lower atomic number, neptunium-239 is more stable than plutonium-239.

## Going Beyond— The Transuranic Elements

Scientists are constantly on the alert to discern "patterns" in natural phenomena — the understanding of such patterns frequently leads to powerful scientific ideas or generalizations. A classic example can be drawn from the field of astronomy. The greatest naked-eye astronomer of all times was undoubtedly Tycho Brahe, who lived in the latter part of the 16th century. Brahe made observations on the positions and motions of the planets with such accuracy that his tables are still used by modern-day astronomers. As Brahe became older he employed a young assistant to copy his data. In the process, the young assistant, whose name was Kepler, picked out a "pattern" in the observations. From this pattern, he established the three laws of planetary motion that bear his name. It is interesting to speculate whether either man alone could have developed the laws. Could Brahe, the great observer, have been able to see the pattern in his observations, or could Kepler, the great theoretician, have been capable of making the detailed observations needed to discern the pattern?

Can you see patterns in a set of data? Try your hand on this one.

Plutonium, like all other elements whose atomic number is greater than 92 (uranium) is one of the so-called *transuranic elements*. None of these elements exists in appreciable amounts in nature. They are all man-made, and they are all radioactive. To date, 11 such elements have been produced. Each has several isotopes. Some of the isotopes have such short half-lives that obtaining data on them is practically impossible.

Below is a listing of the transuranic elements together with the half-life of the isotope that is the longest lived. Study the table; see if you can discern one or more patterns, then answer the questions that follow.

| *Atomic number* | *Element* | *Isotope of longest known half-life* | *Half-life of isotope* |
|---|---|---|---|
| 93 | neptunium | 237 | $2.2 \times 10^6$ yrs |
| 94 | plutonium | 244 | $7.6 \times 10^7$ yrs |
| 95 | americium | 243 | $8 \times 10^3$ yrs |
| 96 | curium | 248 | $5 \times 10^5$ yrs |
| 97 | berkelium | 247 | 1000 yrs |
| 98 | californium | 251 | 800 yrs |
| 99 | einsteinium | 254 | 480 days |
| 100 | fermium | 256 | 1.5 hour |
| 102 | nobelium | 253 | 10 minutes |
| 103 | lawrencium | 257 | 8 seconds |

1. What is the general relation between atomic number and the longest known half-life of the isotope?

2. Where does the "pattern" stated in answer to Question 1 above fall down?

3. What other pattern or patterns seem to modify the principle you stated in answer to Question 1? (Hint: Play "odds and evens." How do the half-lives of isotopes with odd atomic numbers and odd atomic weights compare with those of neighboring elements whose atomic numbers and weights are even? How about the "even-odds" and the odd-evens"?)

4. State at least two principles (and possibly three), which, when combined, can be used to predict generally the half-life of the isotope of longest life of a transuranic element.

5. On this principle, what would you expect to be the approximate half-life of the longest-lived isotope of element 104? How certain are you of your answer?

6. Suppose that when element 104 is discovered, its longest-lived isotope has a half-life of one second; how would you feel about your "theory"? What if it had a half-life of one minute?

Here's another question about transuranic elements you may want to try the "pattern" technique on. Nobelium is produced by bombarding curium with nuclei of carbon-12 atoms. How will element 104 probably be made?

8. Two of the transuranic elements *do* exist in nature in very minute quantities. Which ones are they, and how were they produced?

## Following the Films

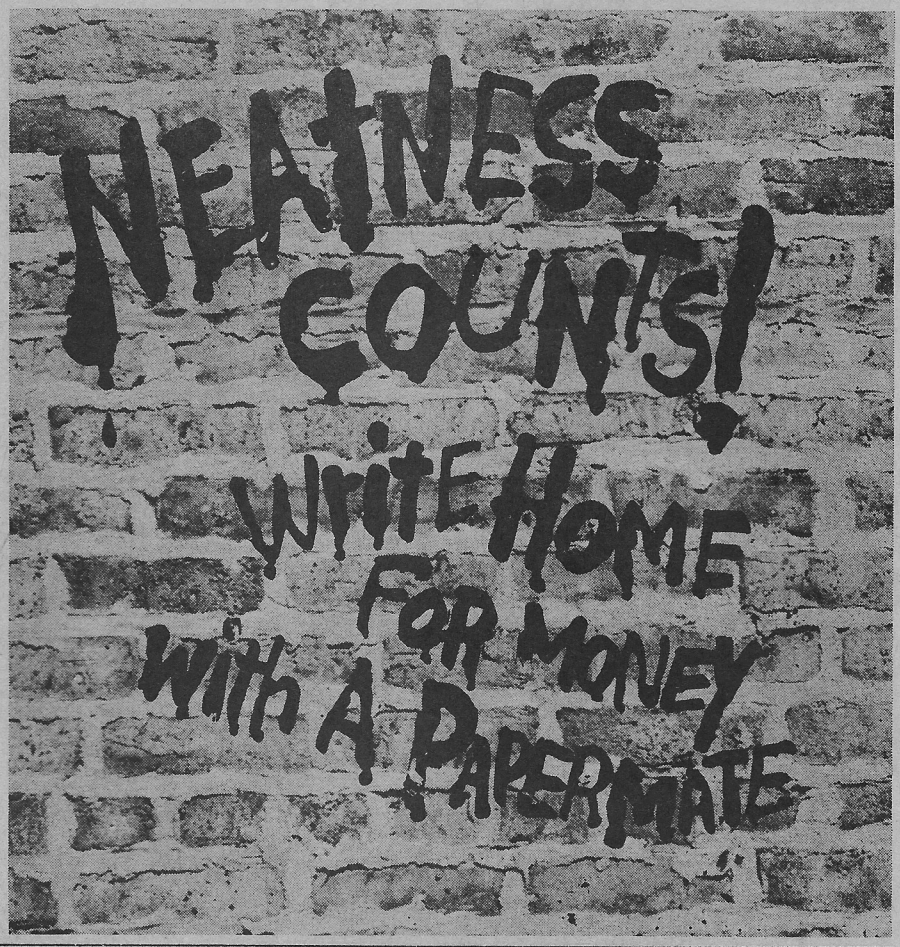
*continued from page 17*

colored comic strip. We don't have to worry about their problems, so we can just sit back and enjoy their antics.

Christopher Gill (Rod Steiger) is a theatrical entrepreneur with a fatal weakness. He can't resist doing in an occasional middle-aged woman, and then boasting about his crime over the telephone to police detective Morris Brummel (George Segal). Oddly enough, Gill never gets around to Morris' mother (Eileen Heckart), a shrew who henpecks her unfortunate son without mercy. The only bright spot in Morris' daily grind is Kate Palmer (Lee Remick), a pretty girl he finds and almost loses in the course of investigating Gill's crimes.

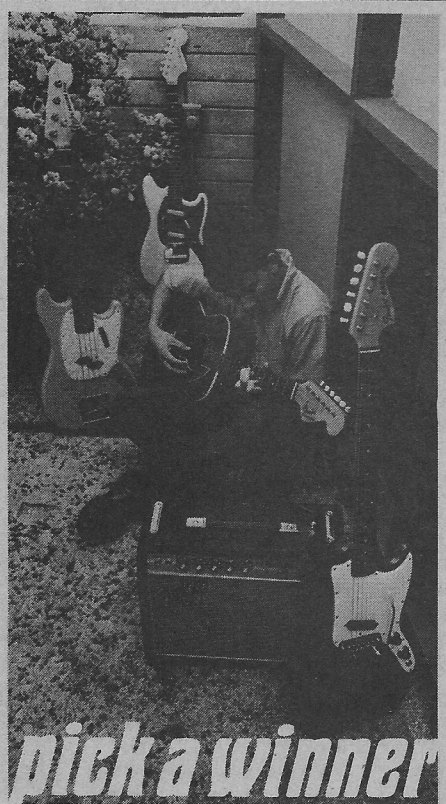
Actor Rod Steiger has a wonderful time donning the different disguises that he uses to gain the confidence of his victims. One minute he pops up as a German plumber. The next thing you know, he's a hairdresser or a waiter, or a parish priest. George Segal is excellent as the downtrodden cop alternately needled by the strangler's telephone calls and by his mother's nagging. We just have one carping question to ask. What is a nice girl (and fine actress) like Lee Remick doing in a comic strip?

— MARGARET RONAN

**What does it take to pick up the pieces?**

It may take only seconds for disaster to strike. And strike hard. And do you have any idea of what it takes to pick up the pieces? The American Red Cross, for one thing. How? With food, clothing, shelter. With material aid in repairing and refurnishing homes. With medical and nursing care. This takes money. In the past two years alone, we spent nearly 32 million dollars helping victims of hurricanes, floods and other disasters. We need your support. **The American Red Cross.** help us help

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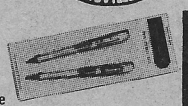

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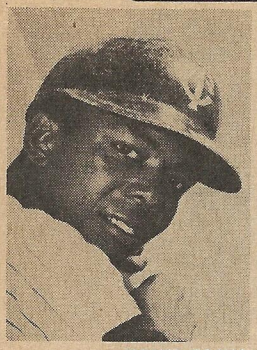
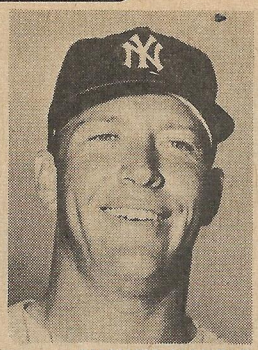
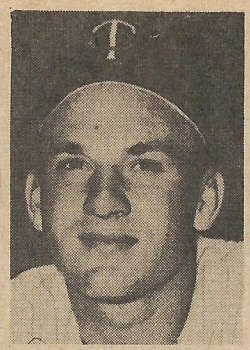


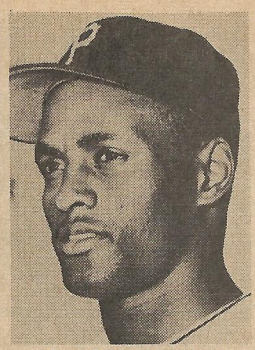
TONY OLIVA
"Future"



MICKEY MANTLE
"Can't Miss"



HARMON KILLEBREW
"Possible"



ROBERTO CLEMENTE
"Can't Miss"

# HALL, HALL, THE GANG'S ALL HERE!

FRANK ROBINSON
"Probable"

WANT to start a war? Just drop this bomb into your next baseball bull session: *Which of the current stars do you think will make the Hall of Fame?*

As you may know, players become eligible for this honor five years after their retirement. The baseball reporters do the voting. All players named on 75 per cent of their ballots are promptly measured for haloes.

*Can't Miss.* Four players wear this label. They are Mickey Mantle, Willie Mays, Hank Aaron, and Roberto Clemente. Not a doubt about any of them. All are (or were) terrific hitters, fielders, runners, and throwers.

Roberto can't clout with the power of the other three, but he has been the best hitter in baseball over the past seven years. And he has won more batting titles (four) than anyone now in the game.

*Probable.* Frank Robinson belongs in this class. A terrific slugger with a lifetime batting average of .304, he's the only man in history to have been voted "Most Valuable Player" in both leagues (National League, 1961; American League, 1966). He averages about 35 homers and 100 runs batted in every year, and he can run and field. His arm is his only question mark. So what? The way he bombs the ball, he could roll the ball into the infield and still be an all-star.

*Possibles.* When Al Kaline won the American League batting crown at age 20, everyone started predicting "immortality" for him. Imagine a fellow of that age hitting .340 with 200 hits and 102 RBI's, and who could field, throw, and run with the best.

Al has had some good seasons since then, but he has never quite made the super class. At age 33, he hasn't too many years left. If he can hit .300 for a couple of more years, he'll have a shot at the Hall on the basis of his great all-around ability.

Orlando Cepeda needs about three more good years to rate a chance at the Hall. A solid power hitter with a lifetime batting average of .309, Orlando is the best first baseman now in the business. If he can find the home run range again – after averaging about 35 homers a year, he dropped to 20 and 25 in his last two full seasons – "The Bull" would look pretty good to the voters.

Harmon Killebrew has an outside chance for the Hall. He can't field or run, or hit for average. But if he keeps whacking those homers and batting in those runs, he'll demand consideration. Barring injuries, he's probably going to wind up with more than 500 homers and 1,200 RBI's, and only the immortals carry such credentials.

Eddie Mathews falls in the same category. Though no fancy dan in the field, he's the greatest power-hitting third baseman of all time. His 509 homers and 1,445 RBI's can be his ticket to the Hall of Fame.

Ken Boyer, now in the twilight of his career, was the best all-around third baseman in the game for ten years. An excellent fielder, a steady hitter (who averaged around .300 in his prime), and a top RBI man, Ken was a truly great ball-player.

Juan Marichal was racing along to the Hall of Fame until he tripped over an injury last season. Poor Juan has had to pitch in the shadow of Sandy Koufax all his life. But from 1963 through 1966, the Giants' right-hander won 25, 21, 22, and 25 games, had earned-run averages of 2.41, 2.48, 2.14, and 2.23, and struck out more than 224 batters every year. That's definitely the stuff out of which Hall of Famers are made. If Juan can pick up where he left off in 1966, he'll become a solid candidate for the Hall.

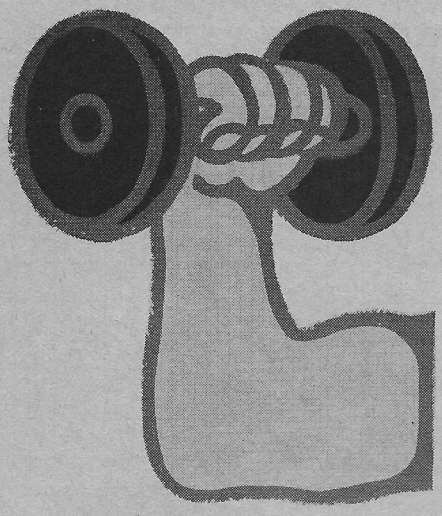
*Maybe.* Now that the Cubs have become a top team, Ron Santo is finally getting the fame he has always deserved. He plays a good third base, hits around .300, and averages 30 homers and 100 RBI's a year. At age 28 he has reached his peak. Give him five more good years and he could wind up an immortal.

*Futures.* After three great years, including two batting crowns, Tony Oliva started off horribly in 1967 but came back strong in the stretch. Five or six more top seasons, and people may start thinking of him in Hall of Fame terms. He can hit for average, has power, can run like a deer, and is a good fielder.

If Richie Allen ever grows up, he might slug his way into the Hall. The Phillies' third baseman is still learning how to field and throw, but he has a lifetime batting average of .311 and is only 26 years old. All he has to do is stop sulking and keep whacking baseballs out of sight.

Carl Yastrzemski? The Red Sox socker won a batting crown in 1963 and batted .312 in 1965, but never really hit with power. He went into a sulk in 1966 and, then, POW! He exploded with a fantastic season. The question now is: Was 1967 a freak year or did it mark Yaz' coming of age? If Yaz is really a .326 hitter who can clout 44 homers and drive in 121 runs (and field, run, and throw like a Willie Mays) – all of which he accomplished last season – the voters are going to have a lot of trouble keeping him out of the Hall of Fame.

– HERMAN L. MASIN, *Sports Editor*



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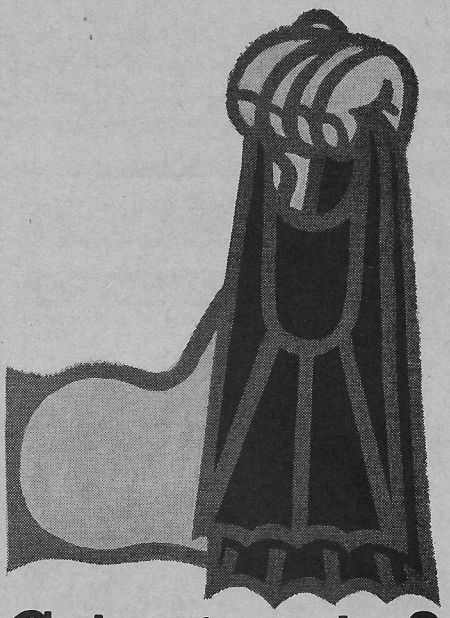
is a beauty, and that of *Jeux* a revelation —capturing the changing moods of the ballet's three-cornered flirtation between a boy and two girls on a tennis court in ways that other recordings (including those by Munch and Ansermet) only hint at. Whatever one may think of Boulez as a composer, he is indeed a formidable conducting talent. (R.H.)

**Sibelius: Valse Triste; Swan of Tuonela; & Finlandia—Herbert von Karajan, Berlin Philharmonic** [*Deutsche Grammophon 139016*]. The best interpretations and most sumptuous performances of late Romantic orchestral works are no longer coming out of Philadelphia, Boston, or New York. And the reason is Karajan and the Berliners. This new Sibelius LP is the latest to prove the point. Karajan brings a depth and breadth plus a tonal splendor these works rarely get any more. His *Valse Triste* is, in fact, the best I've ever heard. All but the *Valse Triste*, incidentally, have been included as "fills" on other Karajan LPs of Sibelius symphonies or concertos so this release really amounts to a recoupling for those who prefer just these shorter "tone poems." (R.H.)

**America's Favorites—Kate Smith, Arthur Fiedler & the Boston Pops** [*RCA Victor LSC2991*]. Kate Smith and Fiedler's Pops have several things in common: they're big musical instruments that like to make big sounds and they're versatile in handling almost all kinds of American music written between 1776 and 1976 (and probably well beyond then). Their teaming is thus a natural. And "square" as the program may seem ("Danny Boy," "Thine Alone," "Be My Love," etc.), it comes off with more all-American honesty than we're likely to get from this year's election campaign platforms. But how, oh how, could they have *not* included "God Bless America"? They each can do it so stirringly—individually—that a collaboration would have seemed a natural for this disc. (B.R.)



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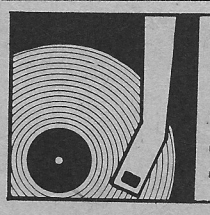

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with Robin McBride, Ed Coach, Buzz Royden

CLASSICAL ALBUM OF THE WEEK

**Debussy: La Mer (The Sea); Jeux (Games); & Afternoon of a Faun—Pierre Boulez, New Philharmonia of London** [*CBS 32110056*]. This LP has already created quite a stir in Europe, where composer-conductor Boulez has suddenly become the darling of the critics. The praise is, for the most part, well deserved — as U. S. concertgoers got a chance to learn recently when Boulez guest-conducted the Cleveland Orchestra for several weeks. Boulez is indeed an extraordinary conductor, who can illuminate the tonal textures and rhythmic pulse of scores (like these by Debussy) with rare skill. His *La Mer* may not be quite as exciting as either Toscanini's or Munch's (both on RCA Victor), but it is more subtly dynamic and brilliantly prismatic—qualities that should have long "staying power" in an LP collection. The *Faun* performance

**Boulez: a revelation**

**Film Fame—Enoch Light & The Light Brigade** [*Project-3 PR5013SD*]. When it comes to orchestral arrangements of movie music, there are few who can touch Enoch Light. This time he serves up themes from *To Sir with Love, Bonnie and Clyde, For a Few Dollars More, Wait Until Dark*, and eight other current releases—all in the brightest Project-3 stereo sound. (R.H.)

POPULAR ALBUM OF THE WEEK

**The Beat Goes On! —Vanilla Fudge** [*Atco 33-237*]. Here's one of the most striking albums of the year. Actually, it's a collection of music and sounds set in a wild and creative rock framework. Whether it involves the voices of Churchill or Kennedy, a capsule history of rock'n'roll, or a modern interpretation of Beethoven compositions, the approach is mostly entertaining, sometimes thought-provoking, and always effective listening. With this LP The Fudge points to an interesting new direction in pop albums. (R.M.)

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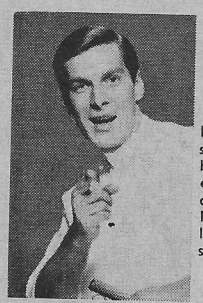

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## ANSWERS TO PUZZLE

(see page 24)

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SENIOR SCIENCE 4-11-66

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# PROJECT POINTERS

# Structural Strength

THE WINGS of every aircraft (whether a mighty passenger liner or your own flying model) are both very light and very strong. The wings that lift a heavy, cargo-laden fuselage are themselves quite light. Yet they can bear tremendous stresses without failing.

What is the source of this strength? The basic explanation lies in the principle of the hollow column, or *monocoque*. You can demonstrate this principle with little more than a few sheets of cardboard. It is easy to measure, for example, the ability of a structure to withstand *compression* (crushing) and *torsion* (twisting).

Start by folding a piece of cardboard once, to form a right angle. Place a lightweight book on top of the angle formed by the two halves of the folded cardboard. Add more books until the cardboard collapses. How much weight was needed?

Repeat this procedure with two, three, and four folds in the cardboard, as shown in Fig. 1. How much weight is required to collapse each structure? Record the figure for each case.

Roll a similar piece of cardboard into a cylinder by overlapping and fastening together the opposite ends of the sheet (see Fig. 2). Again, use books or other weights to load the top of the upright cylinder. Record the weight required to collapse the cylinder.

Next, cement cardboard rings inside the cylinder as indicated in Fig. 2. Load the cardboard cylinder ("fuselage") again until it collapses. How much weight does it take to collapse the cylinder now?

The rings inside the hollow cardboard column increase the compression that the structure can bear. As you work through the various tests, you will generally find that the strength of the column is increased by each reinforcement. Repeat the tests above against the *sides* of each cardboard column (with the column resting on its side). All of the tests outlined so far are tests of compression.

The skin of an aircraft is stiffened to withstand twisting by using *stringers*. To show the effect of the stringers, first measure the strength of a structure containing only the rings.

Hold one end of the cylinder in a fixed position. Apply a twisting force to the other end by hanging weights from a piece of cloth tape fastened to a tack pinned to a wood block at the free end of the fuselage (see Fig. 3). Record the torsional force needed to distort the cylinder, as indicated by the amount of weight attached to the tape.

To show how stringers prevent collapse due to slight torsional forces, fit experimental hollow columns with ⅛-inch by ⅛-inch wooden sticks. Cement these stringers to the inside walls of the cylinder (see Fig. 4). Now repeat the torsion test on the new cylinder. How much torsional force can the new structure withstand?

As you will show, a structure containing both rings and stringers will safely bear much greater torsional forces than a cylinder without stringers. What effect do the stringers have on the cylinder's resistance to bending?

— ALEXANDER JOSEPH

Figure 1

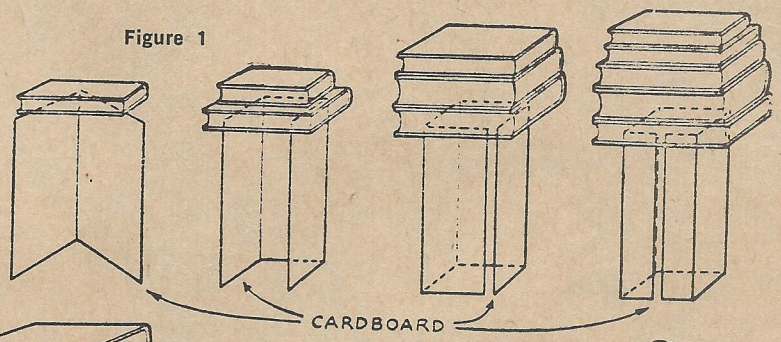



Figure 2

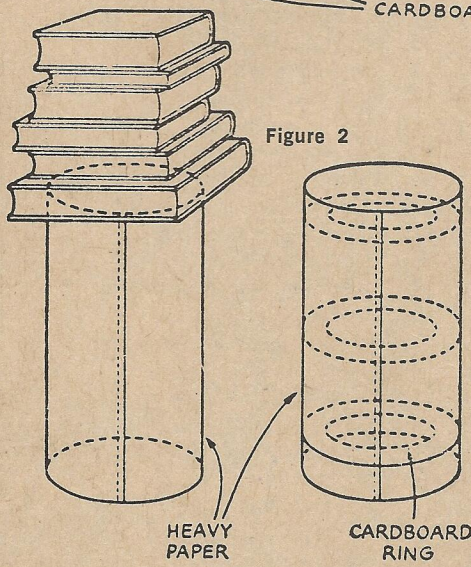



Figure 3

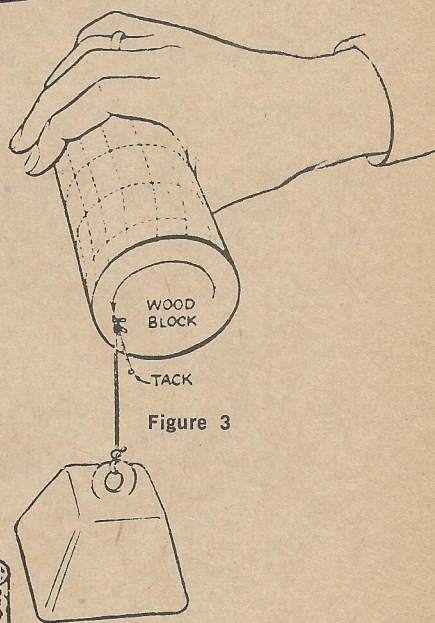
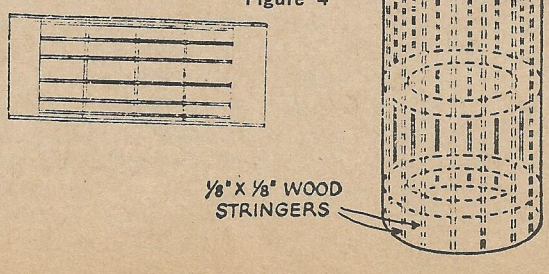



Figure 4

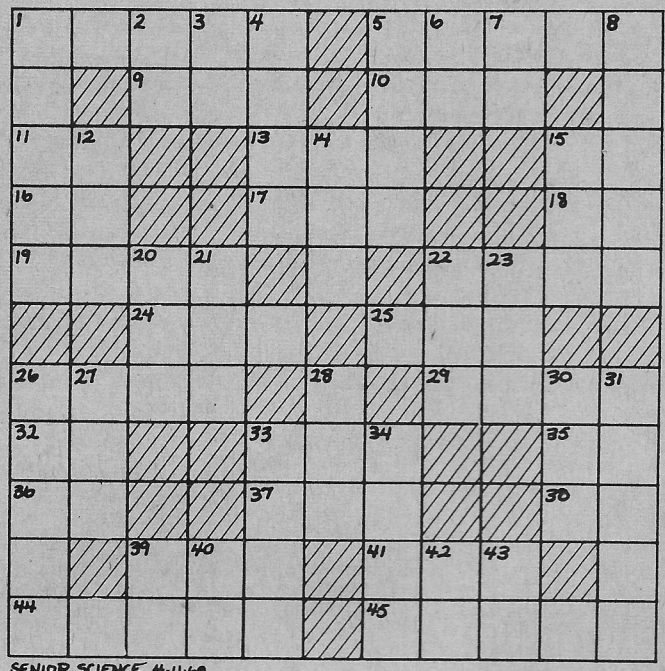


# *Math Path*

**By Nancy Gowin, Morrisonville H. S., Morrisonville, Ill.**

★ Starred words refer to mathematics

Students are invited to submit original crossword puzzles for publication in *Senior Science*. Each puzzle should be built around one topic in science, such as astronomy, astronautics, botany, geology, electronics, famous scientists, etc. Maximum of 50 words, of which at least 15 must be related to the theme. For each puzzle published we will pay $10. No entry will be considered unless it includes all of the following: symmetrical puzzle design and design with answers filled in, definitions, answers on separate sheets, and a statement by the student that the puzzle is original and his own work. **Puzzles must be symmetrical.** Keep a copy, as puzzles cannot be returned. Give name, home address, school, and grade. Address: Puzzle Editor, *Senior Science*, 50 West 44th Street, New York, N. Y. 10036. Answers to this puzzle are on page 22




## ACROSS

* 1. Two of these undefined geometric elements suffice to determine a line *(sing.)*.
* 5. Prefix indicating "four."
9. Female antelope.
10. Conjunction.
11. Opus *(abbr.)*.
13. Runs batted in *(abbr.)*.
*15. 3.14.
16. Osmium *(chem. sym.)*.
17. Prefix meaning "ill."
18. In the direction of.
*19. Calculate.
*22. Basic unit of weight in the metric system.
24. International Association of Machinists *(abbr.)*.
25. Abbr. for famous automobile club.
26. Slippery.
29. A stair.
32. A liquid measure.
33. State famous for potatoes *(abbr.)*.
35. Railroad *(abbr.)*.
36. Upper Canada *(abbr.)*.
37. A certain woodwind *(slang)*.
38. American soldier *(slang)*.
39. In favor of.
41. Instransitive *(abbr.)*.
*44. The path of a point or curve moving according to some law.
45. Water vapor.

## DOWN

* 1. A process for checking a theory.
* 2. Inside diameter *(abbr.)*.
* 3. Number *(abbr.)*.
* 4. Part of an equation.
5. Flexible appendage.
6. Typesetter's measurement.
7. Abbr. for football term.
* 8. Statement needing no proof.
12. Pounds per square inch.
14. Flying mammal.
15. Parent Teachers' Association.
20. Nothing.
21. Period of light between sunrise and sunset.
22. A state of matter.
23. Long-tailed rodent.
*26. Evenly proportioned.
27. Et cetera.
28. Food and Drug Administration *(abbr.)*.
30. Unit of work.
31. Refracts light.
*33. Triangle with two equal sides *(abbr.)*.
*34. A straight line through the center of a plane figure or solid.
*39. Per cent *(abbr.)*.
40. Ruthenium *(chem. sym.)*.
42. Abbr. for a particular Christian book.
43. Tellurium *(chem. sym.)*.

# Science on TV

## The Undersea World of Jacques-Yves Cousteau

*(Mon., April 15, 7:30 P.M. EST, ABC-TV)*

French oceanographer Jacques-Yves Cousteau takes viewers on a deep-sea adventure in the Indian Ocean in *Search in the Deep*. A major portion of the hour-long special will focus on the one-man submarine designed by Cousteau that can reach depths of 2,000 feet, and is one of the most maneuverable machines ever built.

The ship was launched off the island of Europa, which is 200 miles off the east coast of Africa in the Indian Ocean. The sub, piloted by a diver who lies in a prone position, developed some mechanical trouble, which will be described on the telecast. One of its primary uses is for underwater photography.

Europa is also the nesting place for the green turtle, a huge reptile that can weigh up to 800 pounds when full grown. Viewers will see the turtles laying their eggs, the eggs hatching, and the baby turtles rushing instinctively to the sea. Films also show Cousteau's divers riding turtles in the water.

## National Geographic Special

*(Tues., April 16, 7:30 P.M. EST, CBS-TV)*

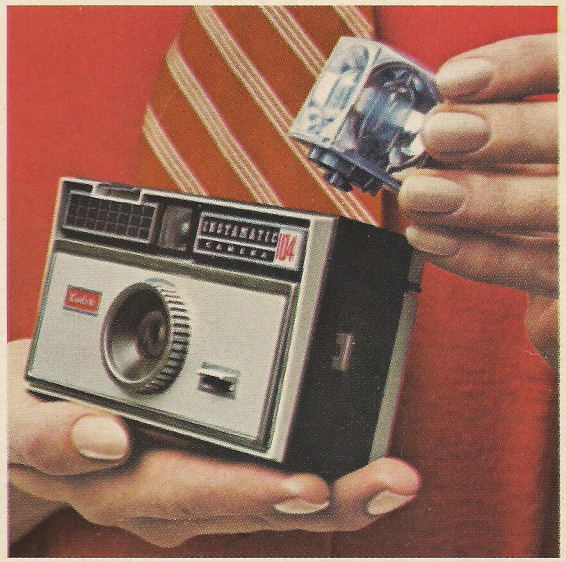
*The Lonely Dorymen—Portugal's Men of the Sea* is a filmed account of the Portuguese fishermen who spend six months at sea in an annual adventure to help feed their countrymen. The hour-long special, produced by the National Geographic Society in association with Wolper Productions, follows the fishermen and their fleet of schooners and trawlers in a 6,500-mile search for cod.

The fishermen embark at Lisbon and journey across the Atlantic to the Grand Banks of Newfoundland, north to the Davis Straits off Greenland, and back home, a course first charted by their forefathers in the 15th or 16th century. Some 5,400 men make the journey in 33 schooners, six of which are sailing vessels similar to those of their ancestors, and 33 engine-driven trawlers. The actual fishing is done from one-man dories.

Once the cod have been located, the men begin a 20-hour working day to pull the fish from the choppy, fog-bound seas. Superb films show them at work, and show the hardships that accompany six months of life aboard ship — with only one port-of-call.

— Peggy Hudson

# Too easy for words.



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